Electrical World

Report of Technical Discussions at A.I.E.E. Winter Meeting

Memphis' Mobile Cable Test-Set

Farmers Will Use Arc Welders

Serving 2,300-Volt Loads off 4,160-Volt Bus

Simplify TEST PROCEDURE

with these versatile WESTON Test Instruments

The Multi-Purpose, Super-Sensitive Analyzer

(MODEL 772)

A compact and practical wide-purpose instrument with sensitivity of 20,000 ohms per volt, or 1000 ohms per volt, on dc ranges.

Ranges – all self-contained

Voltage, a-c and d-c – 0-1000/250/50/10/2.5.

Current, d-c – 0-10 1 amps. – 0-250/50/10 1 milliamps. and 100 microamps.

Ohms – Full Scale – 30 3 megohms – 30,000/3000 ohms. Center Scale – 250,000/25,000/250/25 ohms.

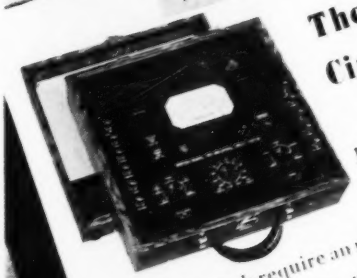
Decibels – –14 to +2, –2 to +14, +12 to +28, +26 to +42, +38 to +54.

(Voltages up to 5000 dc available through use of external WESTON Televerter, Model 766.)

The Direct-Reading, Self-Contained INSULATION TESTER

(MODEL 796)

This compact direct-reading resistance tester eliminates hand cranking and thus makes leakage testing a simple one-man job especially in unaccessable places. Tests up to 200 megohms at test potential of 350 to 500 volts d-c; although, the current at terminals is only a few microamperes. Operates from long life, light-weight batteries. There are no vibrators to replace. Ranges: 0-20-300 megohms full scale; 0-.5-5 megohms center scale. Size 8" x 9⅛" x 8".



The Industrial Circuit Tester

(MODEL 785)

Recognized as the most complete unit for routine maintenance tests, and for testing needs which require an ultra-sensitive instrument.

Ranges all self-contained

D-C VOLTAGE . . . Six Full Scale Ranges of: 1/10/50/200/500/1000 volts (20,000 Ohms per volt).

A-C VOLTAGE . . . Six Full Scale Ranges of: 5/15/30/150/300/750 (1,000 Ohms per volt).

D-C CURRENT . . . Six Full Scale Ranges of: . . . 1/10 50 Microamps . . . 1/10/100 Milliamps. . . . 1/10 Amps. (Higher ranges, at half scale reading, with 100 mv. external shunts).

A-C CURRENT . . . Four Full Scale Ranges of: .5/1/5/10 Amperes. (Higher Ranges with external current Transformers.)

RESISTANCE . . . Five Full Scale Ranges of: 3/30 Megohms. 3,000/30,000/300,000 Ohms . . . Center Scale Values . . . 25/250/2,500/25,000/250,000 Ohms. (Self-Contained Batteries)

With production currently running slightly ahead of war requirements, a limited number of the popular WESTON test instruments shown herewith are available and are offered subject to prior sale. Orders can be placed direct, or with the WESTON representative in your vicinity. Literature available from...WESTON Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON
INSTRUMENTS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 71 YEARS

February 3, 1945 — Vol. 123, No. 5

Contents

Winter Meeting of A.I.E.E. Explores Pressing Problems 72
Electrical engineers foregather to discuss wide variety of war-era problems—Turbo-generator standardization advanced—Circuit breaker disclosed to meet rising interrupting demands—Cable sheath corrosion studied—Comparatively few new developments but numerous conference periods afford occasion for informal matching of current experiences

Arc Welders Are Coming on Farm Service Lines 80

Cable Test Program Uses Portable Kenotron Set 82
JOHN C. PARKER, Memphis Light, Gas & Water Division

Serve 2,300-V. Load from a 4,160-V. Bus 84
G. A. WRIGHT, Moloney Electric Co.

Industrial Capacitor Application Calculations—II 85
JOSEPH S. FRANCIS and STEPHEN FREEMAN, JR., Consumers Power Co.

Editorials ..... 71 and 88

Washington Comment 90

News of the Week 91

HOW 99

Load Servicing 124

New Equipment 132

News About People 136

Manufacturing and Markets 146

Sales Opportunities 149

Recent Rate Changes 151

Rural Allotments and Contracts 152

Index of Advertisements 158

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ELECTRICAL WORLD

Published weekly. Price 25 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to Director of Circulation, Electrical World, 330 West 42nd Street, New York 18, N.Y.

RETURN POSTAGE GUARANTEED

Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years; Canada, $6 for one year, $10 for two years, $12 for three years (Canadian money at par). Great Britain and British possessions, 60 shillings for one year, 120 shillings for three years. All other countries $9 for one year, $18 for three years. Please indicate position and company connection on all subscription orders. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Contents copyrighted, 1945, by McGraw-Hill Publishing Company, Inc.

Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W.C. 2; Atlanta, Ga., Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington.

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office
99-129 North Broadway, Albany 1, N. Y.
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330 West 42nd Street, New York 18, N. Y.

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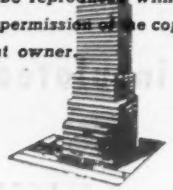

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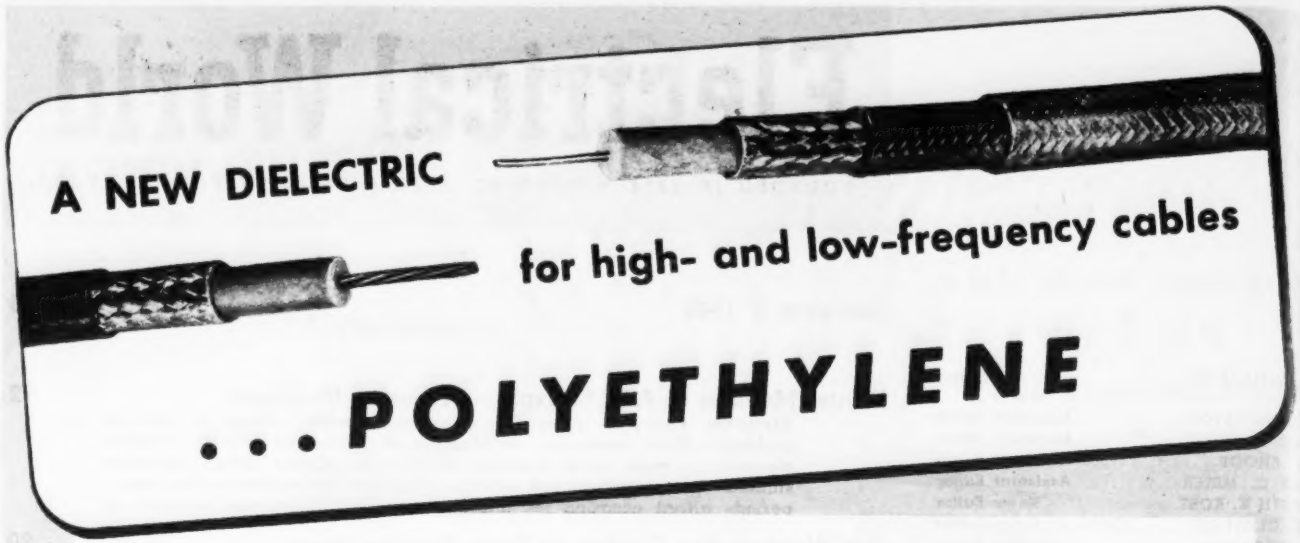


A NEW DIELECTRIC for high- and low-frequency cables ...POLYETHYLENE

In the course of Okonite's research on insulations for electrical wires and cables we have developed or adapted many dielectric materials for specific electrical and electronic applications. One of these is polyethylene which because of its low losses, excellent physical, chemical and dielectric properties, and resistance to ozone and moisture, is now being used for insulating high-frequency cables as well as for radio, communication, control and submarine cables – all for military use. It is also entirely practical for commercial applications.

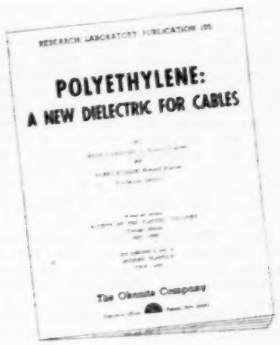
The accompanying table of properties points out some of the advantages of polyethylene.

If you have a problem involving the transmission of electrical power, our Research and Engineering Departments will gladly work with you in designing the wire and cable most suitable for your purpose. It may be that polyethylene will supply the answer, but our work with other insulating materials may point to another insulation for your particular problem. The Okonite Company, Passaic, New Jersey.

PROPERTIES OF POLYETHYLENE AND RUBBER

Property	Polyethylene	Rubber[a]
Dielectric properties		
Dielectric strength, v/m	600-1000	500-700
Volume resistivity, ohm.-cm.	10^{17}	10^{15}-10^{16} (r, v)
Dielectric constant at:		
60 c/s	2.3-2.4	2.3-2.5 (r) 2.4-2.9 (v)
10^3 c/s	2.3	2.3-2.4 (r) 2.7 (v)
10^6 c/s	2.3	2.3-2.4 (r) 2.4-2.7 (v)
Power factor, at:		
60 c/s	0.0002-0.0005	0.002-0.003 (r) 0.004 (v)
10^3 c/s	0.0002-0.0005	0.001-0.002 (r) 0.004 (v)
10^6 c/s	0.0002-0.0005	0.001-0.002 (r) 0.004 (v)
Temp. dependence of dielectric properties	small	small
Chemical properties		
Acids	none	is attacked (r, v)
Alkalis	none	is attacked (r, v)
Oxygenated solvents	none	slight (r, v)
Oil, hydrocarbon solvents	none[b]	soluble (r) swells (v)
Heat (oxidation)	none[c]	considerable (r, v)
Ozone	none	is attacked badly (r, v)
Sunlight	none	considerable (r, v)

a – (r) and (v) refer to raw and vulcanized (2 percent S) rubber, respectively.
b – Is attacked above 60-70° C.
c – Oxidizes above 100° C.



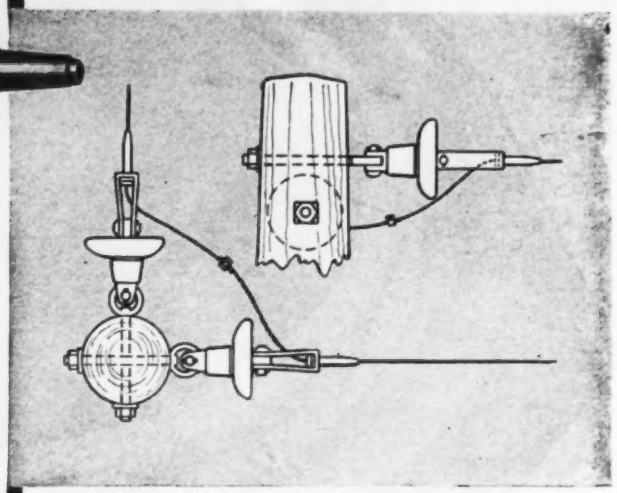
A copy of "POLYETHYLENE: A NEW DIELECTRIC FOR CABLES", a paper describing many other characteristics of this new material, will be sent you on request.

OKONITE insulated wires and cables

3899

Furnished in 3 types for: Guy Strain Insulators, Spool Insulators, Disc Insulators
Electroline Automatic Dead End Feed-Through Type 3300 Series Easy to take up slack. Jumper installation made easy — permits tapping back of dead end
Electroline Automatic Dead End to fit Spool Type Insulators . . . .
Electroline Automatic Dead End to fit Guy Strain Insulators . . .
Electroline Automatic Dead End to fit Disc Type Insulators . . . . . .

A CONSTRUCTION LINEMAN will tell you more about the value of Electroline Automatic Dead Ends in fewer words than the engineers who designed them. The lineman knows, from practical experience, how quickly and easily and confidently he can install Electroline Automatic Dead Ends and guarantee a good job.

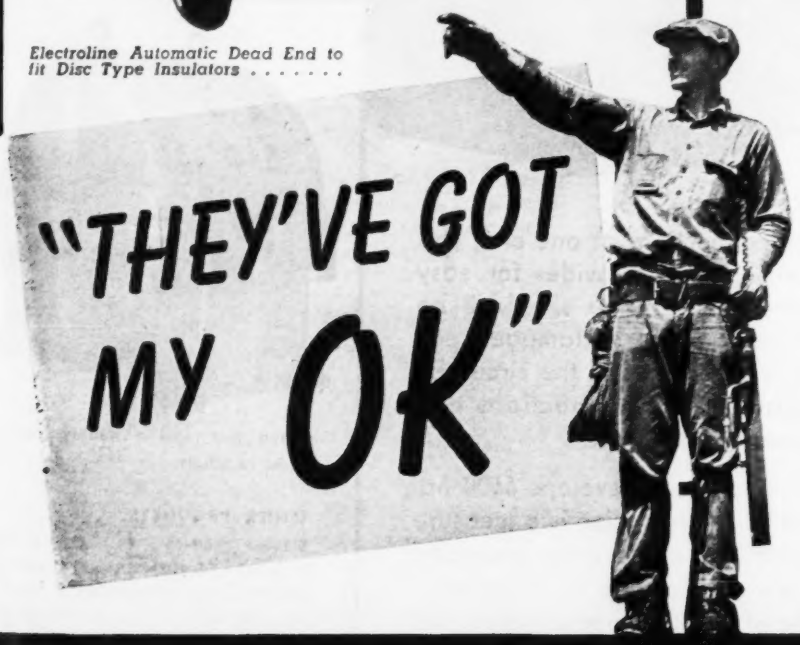


He appreciates these features: Full automatic gripping—no tools nor extra equipment required; Full strength of conductor maintained, without slippage; Full reclaimability for further use. **This Automatic Dead End dampens vibrations and guarantees full life of conductor.**

Utilities have chosen Electroline Automatic Dead Ends to cut construction costs, save time and insure stronger lines.

You may well profit by the same advantages. Get the complete details on up-to-date methods and equipment used in dead-ending. Write for Bulletin.

Prices on Request.



Electroline Company

Originators and Patentees of Automatic Line Splices and Dead Ends

4121 SOUTH LA SALLE STREET • CHICAGO, ILLINOIS

CRAFTSMANSHIP COUNTS!

THIS huge Elliott motor stator and frame is destined for the main propulsion drive of a Maritime Commission vessel.

It is a nice job of motor building. The fabricated frame is exceptionally rigid. Form-wound coils made of transposed strands improve efficiency and reduce heating. The coils are insulated with mica tape and impregnated with a special insulating compound. These coils form a single turn series wave winding, with all connections at one end. This arrangement provides for easy emergency repair should it be necessary, as a damaged coil can be cut out of the circuit by opening the connections and inserting jumpers.

This motor develops 6600 hp. at 93 r.p.m. Its size is a measure of Elliott engineering capacity. Its craftsmanship is characteristic of all Elliott motors, large and small.

When you need a quality motor, come to Elliott.

OTHER PRODUCTS:

STEAM TURBINES • GENERATORS MOTORS • CONDENSERS • FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS • CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES • TUBE CLEANERS STRAINERS • DESUPERHEATERS • FILTERS

ELLIOTT *Company*

Electric Power Dept.

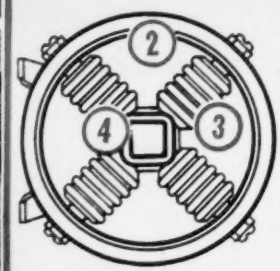
RIDGWAY, PA.

DISTRICT OFFICES IN PRINCIPAL CITIES

L-752

CHECK the FACTS

1. Sealed, dust proof, individual bus housing provides phase isolation and prevents interphase short circuit. Removable covers in unit sections simplify routine inspection.
2. Supporting ring frames equalize all stresses. Can be mounted in any position.
3. With interchangeable insulator units always in compression, porcelain is used to its best advantage.
4. The same conductor support collar is used for both fixed and expansion slide position. Conductor can be square, round, channel or bar, insulated or bare.



Shown here is an application of an Enclosed Isolated Phase Bus, providing protection from dust contamination deposits, at a prominent steel mill in the East. The bus extends from the generator to a wall cubicle inside—shown below; then outside and across to the transformer in the switchyard, as shown above.

The Check List

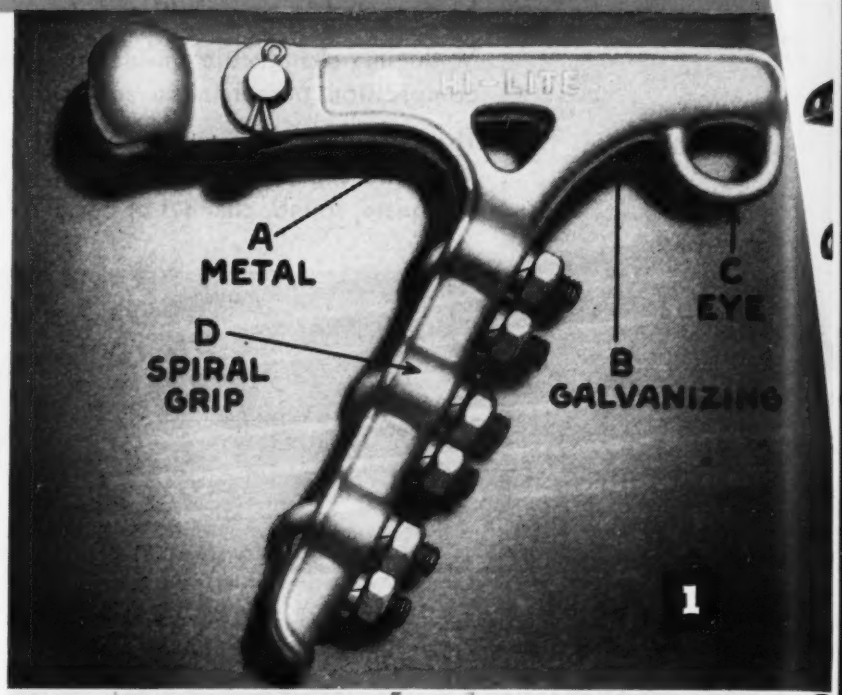
- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

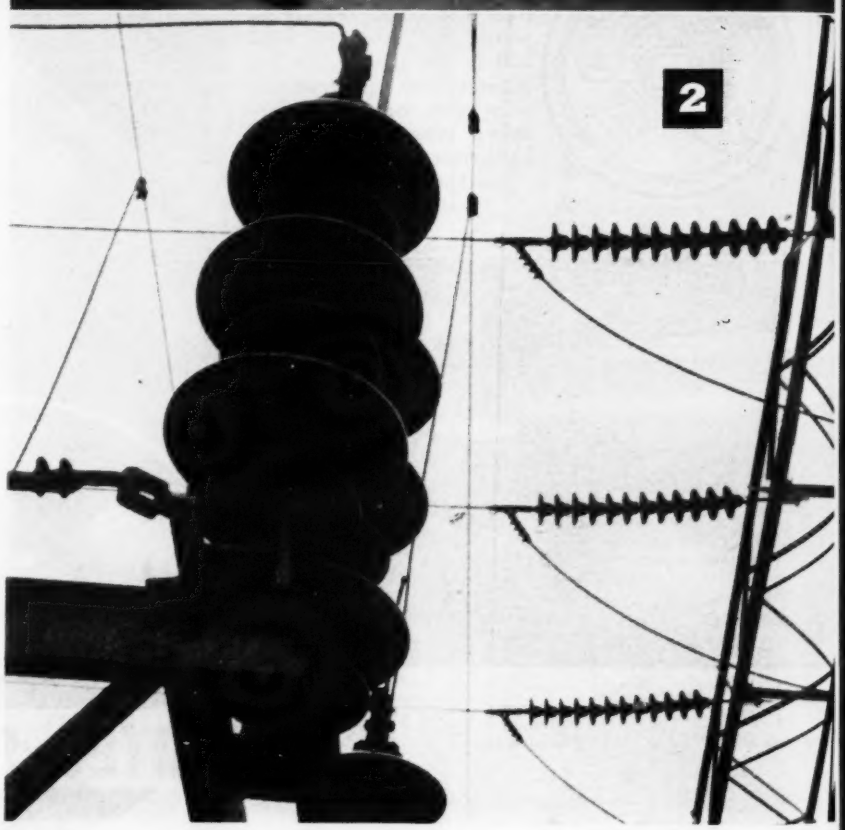
R&IE

ISOLATED PHASE BUS

A COMBINATION
You Can't Ignore
IN BUYING INSULATION

MOST INSULATORS, themselves, are a combination of metal and porcelain parts. The two work together to accomplish a specific job. Here's no place for specialists – where men's interest in one material causes them to ignore the other – where one can be overemphasized at the other's expense. The easiest way to prevent this would be to manufacture both "under the same roof"; to have both under the same general control. Sounds logical, doesn't it? Yet O-B is the only manufacturer of a full line of porcelain insulation that likewise completely owns and operates its own ferrous and non-ferrous metal foundries, and its own forge shops. The reason why O-B porcelain and metal work so well together is because they have been thought of and made together for many years, with the single object of working best in combination -- a combination you can't ignore in the intelligent purchase of insulation.

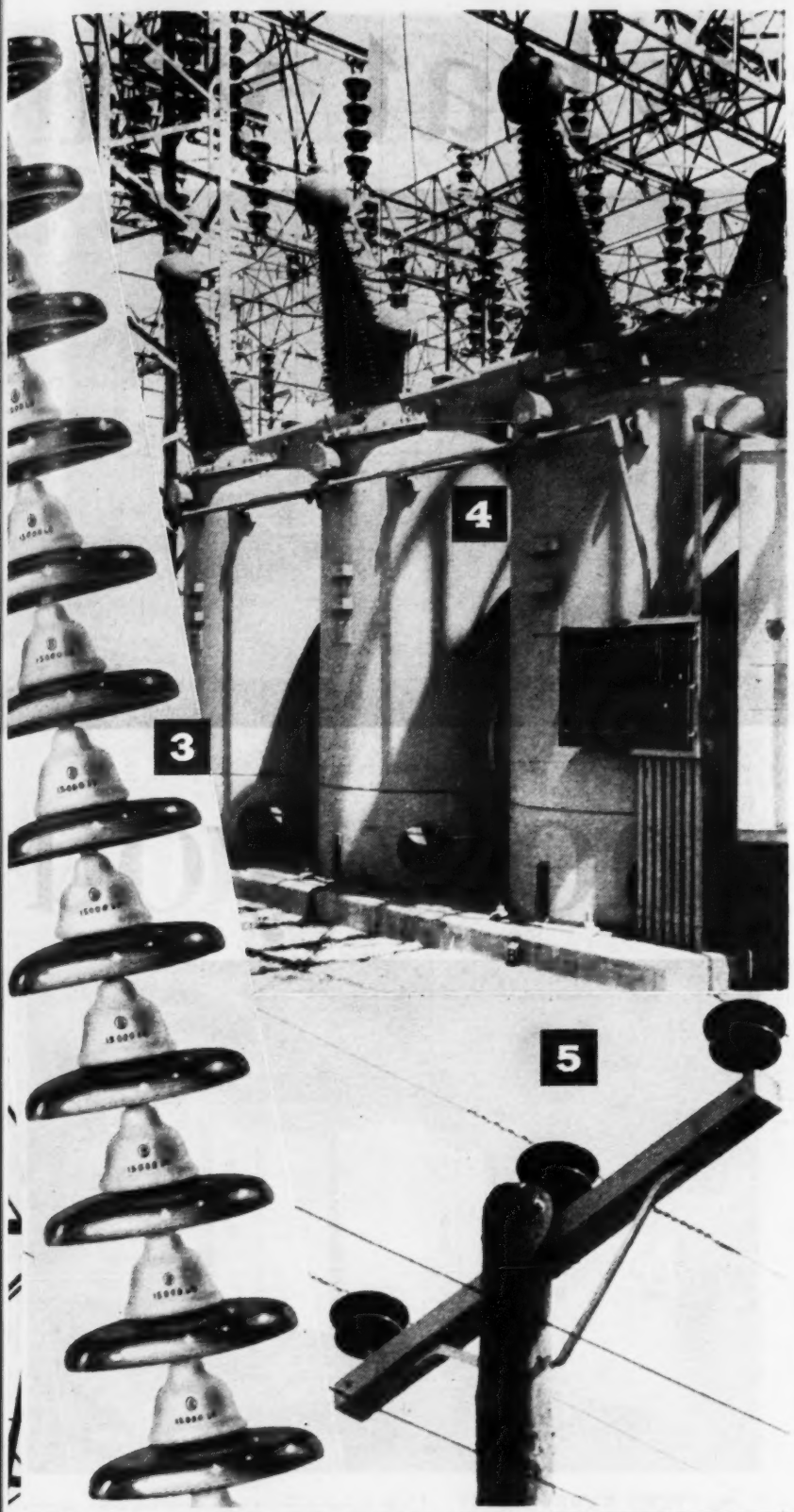




Balanced Hardware Design – Rather than being just that much more tonnage for a foundry, O-B recognizes hardware to be part of its over-all responsibility in safely supporting power lines. Hardware and insulation work together. Only with O-B are they designed together, made together, sold together, and together become a single obligation for best performance.

(A) Malleable iron body combines ample strength with high ductility. O-B clamps exceed ultimate strength of any cable for which they are designed.

(B) Hot-dip galvanizing provides primary protection. Malleable iron assumes a coating of oxide that is impervious to further corrosion; thus preserving original volume and strength of piece.



(C) Fall blocks attached to this eye keep clamp level and permit establishment of exact tension.

(D) A modified spiral snubbing action grips cable securely without deformation of the strands. O-B clamps will develop 90 percent of the ultimate strength of the strongest standard conductor without slip.

You Can't Standardize Performance-- Because switch and bus insulators are manufactured to rigid industry standards, does this make them all the same? It would if you could also standardize the intangible factors of capability, experience, and skill in manufacture -- but you can't. There **is** a difference that can never be specified, and O-B's 30-year service record shows where that difference lies.

A Strong Team -- You can't strengthen a string of suspension insulators by inserting a couple of over-strength units, but you can weaken it by having just one under-strength one. This is why O-B suspensions are rated and branded with minimum unit strength -- the kind of strength that counts, because you can count on it!

Complete Oil Protection-- Air, moisture, even sunlight, are the enemies of Transil Oil. All of these are sealed out in O-B bushing design. This makes the need for inspection and major maintenance rare.

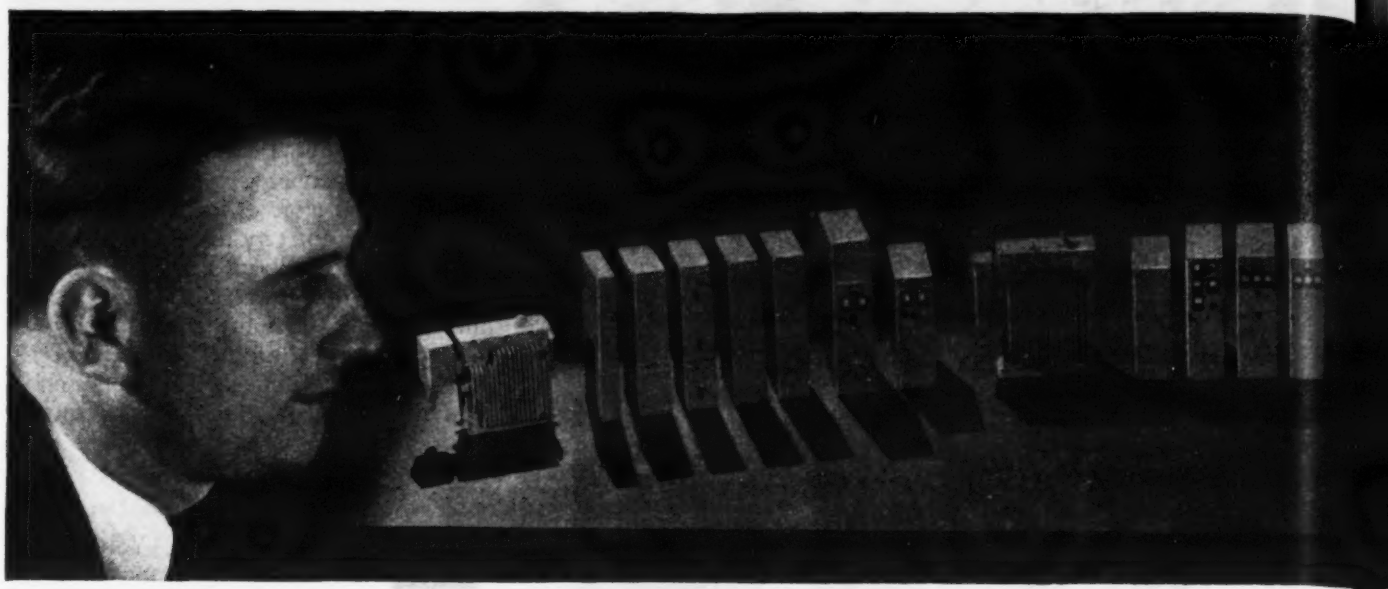
Hard Workers -- Pintype lines seldom enjoy elaborate construction with ground wires, frequent inspection, or regular maintenance, yet one pintype insulator is all there is between line and ground. That's why O-B puts so much into its pintypes.

Ohio Brass

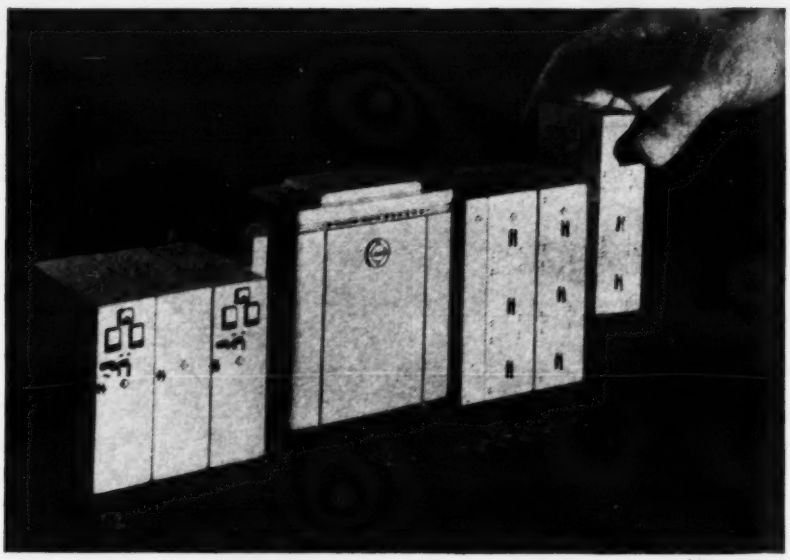
MANSFIELD, OHIO, U. S. A.

CANADIAN OHIO BRASS COMPANY, LIMITED, NIAGARA FALLS, ONTARIO

Here's what you



Here's how you



1 YOU SEE WHAT'S AVAILABLE — without bogging down in tables, charts, diagrams. Accurately constructed—½ in. to 1 ft — models eliminate all guesswork in unit substation planning. And they're idea-stimulating . . . hard to keep your hands off.

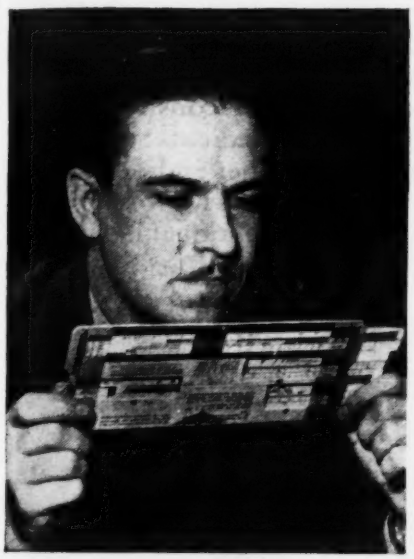
2 YOU EXPERIMENT. Unit substation arrangements are assembled quickly . . . allowing easy comparison of alternate plans. Thirty-eight models permit you to see for yourself the great flexibility of Allis-Chalmers unit sub equipment . . . determine the *right* substation for your plant. A field engineer from your nearby A-C district office will be glad to show the models. There's no obligation.

SEE YOUR UNIT SUB IDEAS WORKED OUT WITH ALLIS-

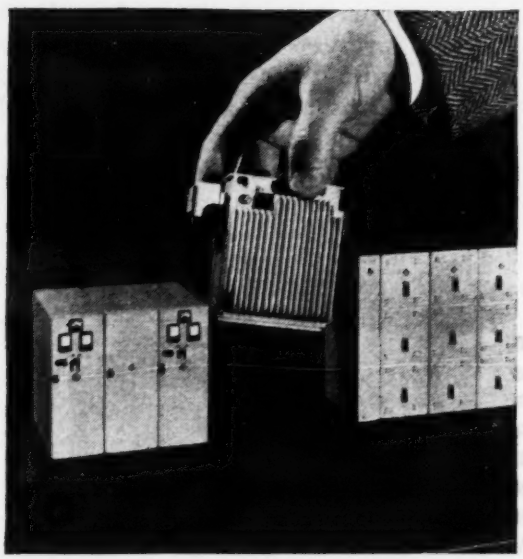
have to work with

work:

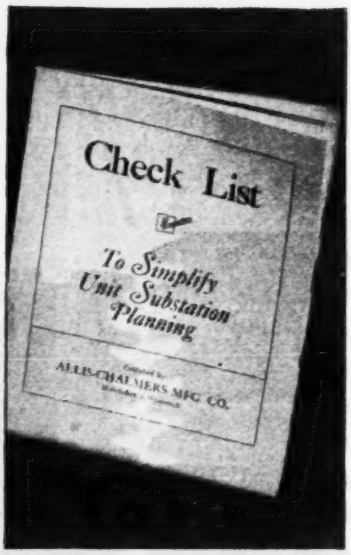
When you use Allis-Chalmers scale models to help solve Unit Sub problems!



3 YOU DETERMINE what size circuit breakers will be needed when you use Allis-Chalmers' handy Unit Sub Slide Rule to calculate secondary short circuit current quickly, easily, accurately.



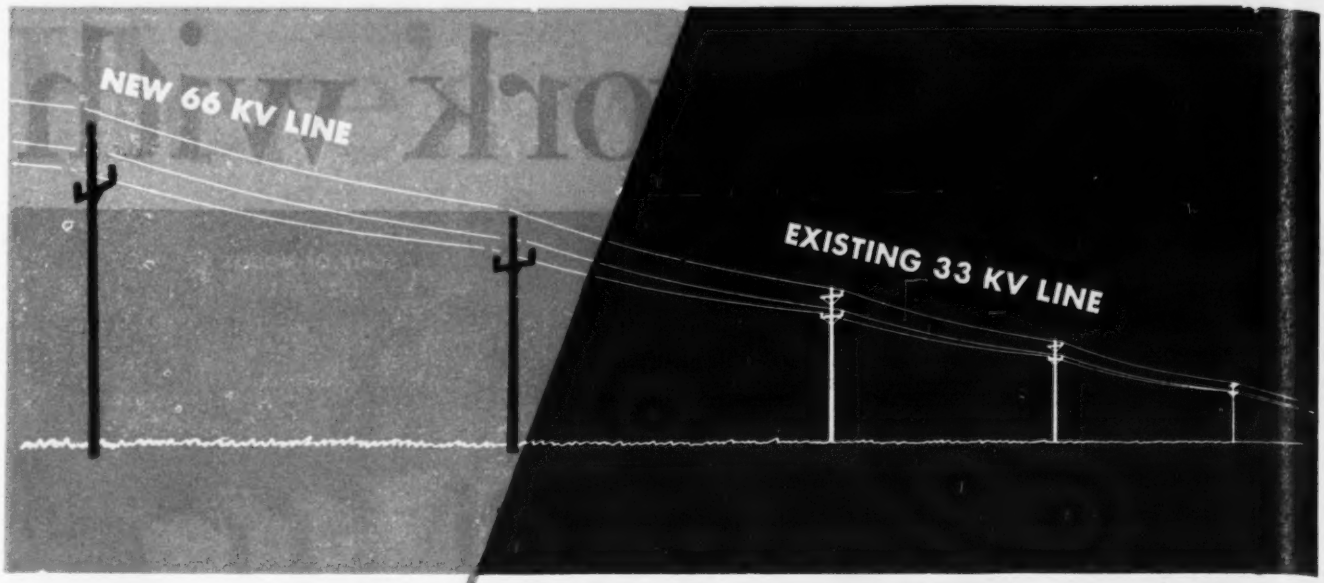
4 YOU VISUALIZE SOLUTIONS to your power distribution problems right on the top of your desk. At a glance, you see what space your proposed unit substation will occupy. You also see how it will look when actually installed in your plant.



5 YOU DOUBLE CHECK with A-C's Check List book which reduces every basic consideration in unit sub planning to its simplest possible form.

Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT. A 1828

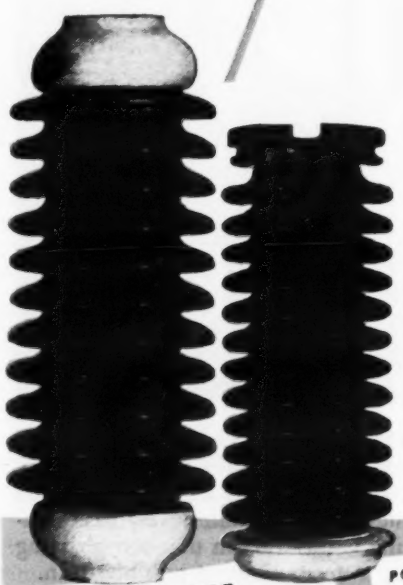
CHALMERS "UNIT SUB BUILDER" SET



LINE CONVERSION WITH LAPP LINE POSTS

is the fastest way to fortify your system.... and uses least materials

New or increased load demands frequently can most efficiently be handled by conversion of existing lines to higher voltage. For this job, Lapp Line Posts are particularly suited. Using present sound poles and conductors, conversion to higher voltages can be accomplished with no more than new cross-arms and Lapp Line Posts. Nor need such construction be considered as an emergency temporary expedient. Such a line approaches the current ideal for a new line; and your Lapp Posts can be expected to give trouble-free service for a longer period of years than you ever got from conventional insulators.



LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

SMOOTH COMMUTATION!

A.C. VOLTAGE CONTROL with TH 2½A TRANSTAT

Brush Arm Assembly

One piece die casting permits good heat dissipation, provides a simple means of replacing the brush and protects the commutator against contact with brush holder if brush should break or loosen.

Core and Coil Impregnated FOR Long Service

Each turn of vinyl acetal insulated wire is PERMANENTLY anchored by impregnation of whole core and coil with phenolic resin, followed by baking.

Broad Commutating Surface

Ground from parallel wires on outer periphery of coil, forms long even segments with solid insulation necessary to avoid shorted turns. Greater contact area results in a lower operating temperature. Smooth, mirror-like finish provides a practically frictionless brush track.

Write FOR THIS NEW FOLDER!

Complete description, including construction details, performance curves, wiring diagrams, ratings, electrical data and applications covered. Ask for Bulletin No. 171-01.

AMERICAN TRANSFORMER COMPANY
178 Emmet Street, Newark 5, N. J.

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK N. J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMER TRAN

SIMPLEX-ANHYDREX UNDERGROUND CABLES

NEED NO PROTECTION FROM *Moisture*

Underground cables for electrical distribution are exposed to moisture which can cause a lot of trouble and seriously interefere with service. Metallic sheaths will keep moisture out of the cables but they often create other problems of electrolysis, corrosion, sheath losses and maintenance. A flexible, non-metallic covering, such as a rubber sheath, that will not absorb water is the ideal protection.

Simplex-ANHYDREX Underground cables are now made with synthetic insulations and sheaths that are suitable for underground service in ducts or directly in the ground. Exposure to moisture, even permanent submersion in water, has no effect upon their electrical stability. For steady, uniform underground distribution Simplex-ANHYDREX Underground cables are what you need.

Our experience with low water absorption insulations over many years is at your service whenever moisture creates a cable problem for you.

Buna S has replaced natural rubber in Simplex insulations.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex

WIRES and CABLES

Stop Wear, Rust and Corrosion with this

BODY-GUARD FOR A BALL BEARING!

THROUGHOUT your busy plant, there are hundreds, perhaps thousands, of grease-lubricated ball bearings like the one shown at the right.

As you know, their efficient operation depends largely upon a grease that continuously covers the highly polished surfaces and provides strong films for protection against wear, rust and corrosion. At the same time, this lubricant must seal out impurities, minimize leakage, make frequent re-packings unnecessary.

Today, in thousands of U. S. plants, Gargoyle Greases BRB, are providing this maximum protection. They are outstanding for their stable structure and their resistance to oxidation and separation over long periods in service.

Get Gargoyle Greases BRB, and be sure your ball bearings have the best body-guards you can buy.

SOCONY-VACUUM OIL CO., INC.
Standard Oil of N.Y. Div. · White Star Div. · Lubrite Div. · Chicago Div. · White Eagle Div. · Wadhams Div. · Magnolia Petroleum Co. · General Petroleum Corp. of Calif.

CALL IN SOCONY-VACUUM FOR "CORRECT LUBRICATION"

GARGOYLE Lubricants

Socony-Vacuum's 5 STEPS to Lower Production Costs for You!

1. Lubrication Study of Your Entire Plant
2. Lubrication Schedules and Controls
3. Lubricant Storage and Handling System
4. Skilled Engineering Counsel
5. Progress Reports of Benefits Secured

SUCCUSSION RESEARCH ON ELECTRICAL CONNECTORS

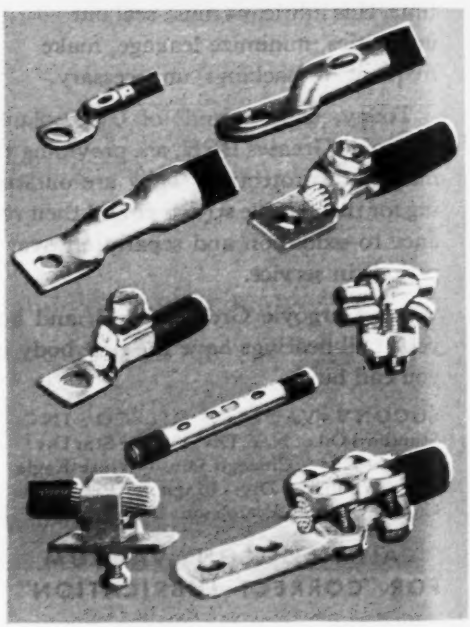
Succussion* in some form . . . from mild vibration to heavy shock . . . is present around every electrical connector in service. If succussion wins, circuit efficiency drops or service stops . . . and costly maintenance begins.

How, then, can you be sure the connections you make, in your product or in your plant, will remain unaffected by mechanical abuse? You'll find the answer here in Burndy's torture chamber where connectors are 'pre-tested' through a rigorous physical 'workout'.

Hour after hour, they are vibrated at varying frequencies and amplitude. But in addition, very unusual methods are employed to add shock, stress and twist as well. After which their electrical resistance and strength are carefully measured to make sure there has been no change . . . that they are worthy of the Burndy name.

These 'physicals' are but part of the thorough test procedure here in the Burndy laboratories . . . all aimed to assure that your circuits or equipment suffer no connection troubles in service. If you don't have the Burndy catalog, let us send you a copy. Burndy Engineering Co., Inc., 107J Bruckner Boulevard, New York 54, N. Y.

*Succussion: forcible shaking, violent shock.



Headquarters for CONNECTORS

Burndy

In Canada: Canadian Line Materials, Limited, Toronto 13

UTILITY MEN!

There's Still Time to Get Your Share of these

EFFECTIVE DIRECT MAIL FOLDERS

UTILITY companies in various parts of the country are ordering large quantities of these powerful street lighting promotion pieces. And soon, they'll begin mailing them out to municipal officials, some of whom may be in territories near yours.

This action is certain to give a big boost to the post-war sale of more and better street lighting, and build good will for utilities . . . because this material is basic in its appeal, contains information civic leaders have requested.

Add your name to the growing list of sponsoring companies *now*. Order enough of the direct mail material and the window displays to influence public opinion in your favor in the communities you serve. The direct mail pieces are available now for your imprinting and mailing at only 45 cents per set of six (10% discount on orders of 100 sets or more). The window displays are $3.50 each, plus postage. For additional information, write The Street Lighting Section, NEMA, 155 E. 44th St., New York 17, N. Y.

—AND WINDOW DISPLAYS

Good Street Lighting Builds Good Will

Melmac PLASTICS

FOR GREATER DIELECTRIC SAFETY!

• *Mineral-filled* MELMAC*, the new insulating plastic developed by Cyanamid, is finding new uses in distributors, magnetos, and many other dielectric parts and is helping to insure quick-starting, smooth-acting, dependable power in stationary and portable engines.

For machinery that must operate smoothly and efficiently, day after day, in spite of constant use, and exposure to dust, dirt, rain, sun, and freezing weather, MELMAC's high heat resistance, non-inflammability and resistance to arc-tracking, mean uninterrupted performance, lengthen the life, and improve the serviceability of electrical equipment.

These are reasons why it is being used more and more in the ignition systems of engines for tractors, water pumps and power plants which must function properly regardless of heat, cold, and humidity, in spite of dust and dirt which cause flashovers and shorts.

Further information on this new industrial plastic and its adaptability to your needs will be supplied promptly. Additional data will be found in the handbook, "MELMAC MOLDING COMPOUNDS," available on request.

*Reg. U. S. Pat. Off.

Typical MELMAC *distributor parts which add to the life and efficiency of commercial type magnetos for trucks, tractors and stationary engines.*

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
30 ROCKEFELLER PLAZA · NEW YORK 20, N. Y.

Cyanamid Plastics

Beetle · Melmac · Melurac
Laminac · Urac

AN IMPORTANT NEW *Silver-Tungsten* CONTACT DEVELOPMENT

STACKPOLE MOLDED CONTACT TYPES

Silver-Graphite

Silver-Copper-Graphite

Gold-Graphite

Silver-Nickel

Silver-Molybdenum

Silver-Tungsten

Silver-Nickel-Molybdenum

Silver-Nickel-Tungsten

and dozens of special alloys.

One-third smaller by volume and with half as many parts! That, in brief, is the story of a circuit breaker produced by a leading manufacturer, and made possible by use of silver-tungsten contacts utilizing the recently developed Stackpole "FW 41" formula.

Thanks to the efficiency of this new contact material, the interrupting capacity of the circuit breaker in *its new small size* has actually been increased from 10,000 amperes to 15,000 amperes. On special test, it has interrupted 21,000 amperes without apparent damage!

FW 41 is but one of many Stackpole contact developments of outstanding importance to electrical equipment manufacturers who realize that contact problems do not stay solved—that today's "best" may well be obsolete tomorrow.

Stackpole engineers welcome the opportunity to study your particular contact application in the light of recent improvements, making their recommendations and suggestions accordingly. The Stackpole contact laboratory includes ample facilities for making contact tests under actual operating conditions.

STACKPOLE CARBON COMPANY, ST. MARYS, PA.

STACKPOLE

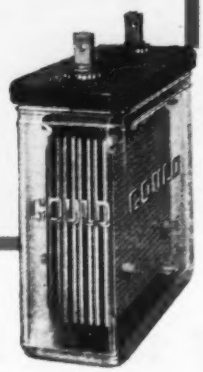
MOLDED METAL POWDER AND CARBON PRODUCTS

ENERGY RATINGS ARE VITAL

Man's energy rating is determined by the basal metabolism test for energy output. A man cannot do efficient work beyond his energy rating.

IN A STANDBY BATTERY

energy ratings are equally vital.



There are many factors to consider in the selection of a storage battery. Energy demands are of prime importance but equally so is the life expectancy of the battery.

No matter what your storage battery requirement may be, Gould is in a position to offer you the benefit of its half century of experience in designing, developing, and building storage batteries. There is a Gould Battery for your individual need.

Write Dept. 122 for Catalog 1000 on Gould Sealed-In-Glass Batteries for Stationary Applications.

GOULD

Since 1898 . . . THE BATTERY PICKED BY ENGINEERS

For Excellence in storage battery production at Depew plant

GOULD STORAGE BATTERY CORPORATION, Depew, New York. Factories: Atlanta • Chicago • Dallas • Depew • Lawrenceville • Los Angeles • North Bergen • Rock Island • St. Paul • Sioux City • Zanesville

THE PLANTÉ WOOD SEPARATOR

One of a series of informative articles for users of industrial batteries

The Gould Plante′ storage battery of today represents nearly half a century of constant research, experimentation and field testing. As a result it contains many features that make it the preferred battery for all standby and control operations.

The Plante′ wood separator is one of its features but among outstanding accomplishments is the positive plate. Made from a single piece of pure lead it is scientifically scored to increase surface area and then electro-chemically treated to form both sides with pure crystalline active material.

Equalling the long life of the positive plate is the Gould Faure type negative, with the two outer plates of a special "barricaded" design that prevents over-expansion and loss of useful negative active material.

For Plante′ batteries Gould has selected Port Orford Cedar for the separator material. These separators are of heavy, durable construction with deep channels, designed to carry the maximum amount of electrolyte possible, yet maintaining necessary mechanical strength.

These channels serve as a reservoir for an excess amount of electrolyte which is vitally essential under high rates of discharge. By having this surplus available for rapid diffusion to the plate surface, it is ready to replace immediately the acid consumed by the high rate discharge. This is another reason for the high sustained voltage of the Gould Plante′ battery.

Port Orford Cedar is the best wood discovered for battery separators, and is obtained from a relatively small area on the West Coast. It is highly porous, low in resin content, and resistant to sulphuric acid. After the separator is cut to size and grooved, it is treated in a caustic solution to remove organic acids and resins.

The manufacturer candles each separator individually, inspecting for possible spot cracks, worm holes, and knot holes and checks the dimensions. It is the constant vigilance of Gould's supplier, instilled by rigid Gould specifications, that aid in bringing into the Plante′ cell as high quality a separator as possible, to balance the high quality and long life of the Gould Plante′ battery.

YOU GET ALL THE COMPRESSED AIR YOU NEED WITH SCHRAMM AIR COMPRESSORS

For the many compressed air jobs in your steam plants, generating stations, and field work, it will pay you to use Schramm Compressors because you get all the air you need with them.

Schramm Compressors are compact, lightweight, and easy to start, merely by pushing a button.

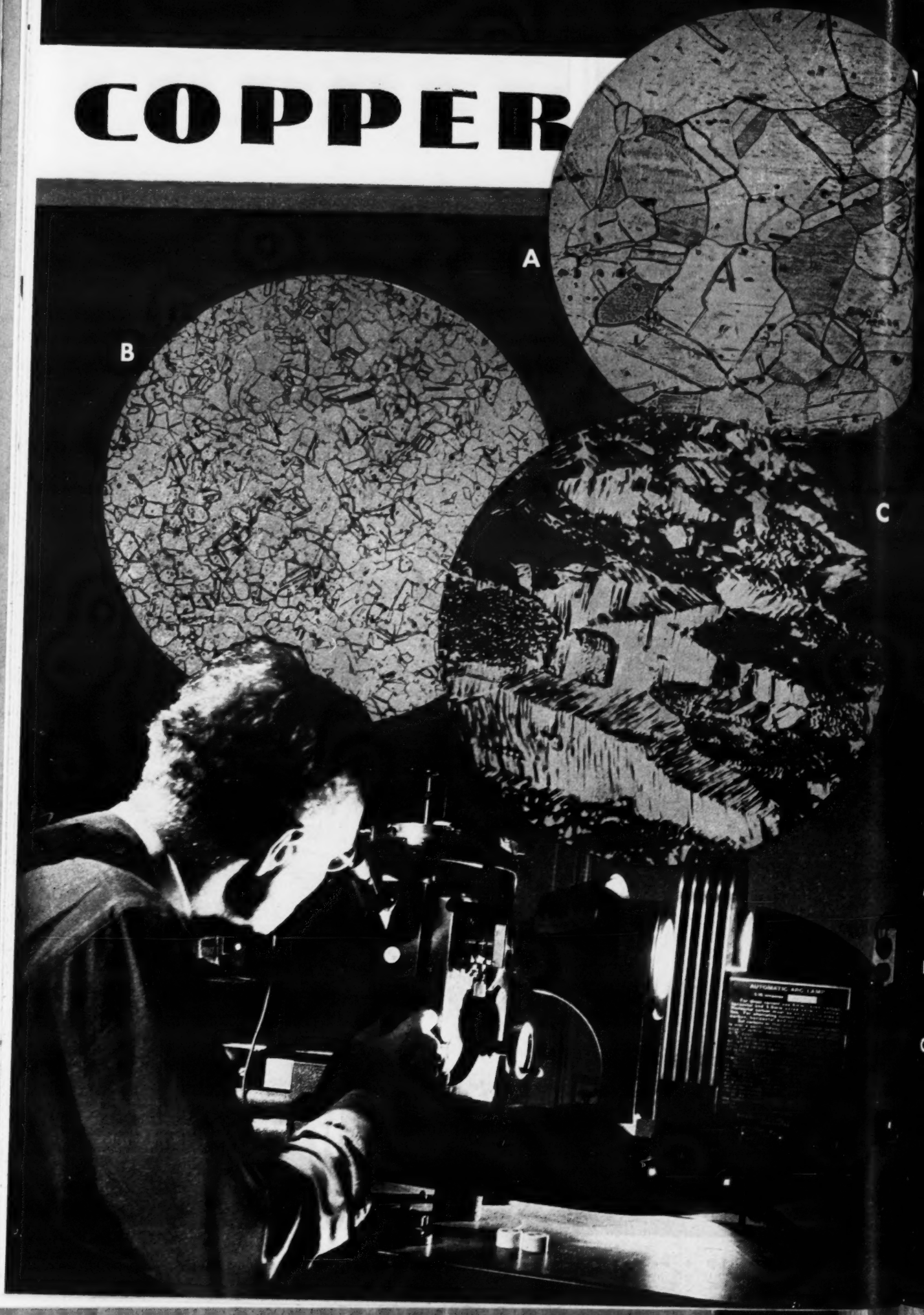
Schramm features include: completely water cooled to provide ideal service both winter and summer . . . main bearings for every cylinder . . . mechanical intake valve . . . more cylinders and lighter parts . . . and forced feed lubrication.

These features provide many advantages and savings. For full details, and descriptions of the various models, portable and stationary, write today for bulletin AED-44.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

COPPER



. IS BASIC

From (1500x) microscopy to pilot-plant testing, Research here seeks constant product betterment

In the General Cable Research Laboratory at Bayonne one soon becomes conscious that this unit is not just a laboratory but an institution on which the technical advance of an industry largely depends. At what speed rate can continuous annealing of copper be accomplished? How control materials for more perfect surface finish? What refinement of raw material and process specifications for specific use-applications? General Cable scientists delve deeply that the end product may be still more serviceable, of still greater uniformity, and of no greater cost.

A Grain structure of annealed hard drawn wire—X1500

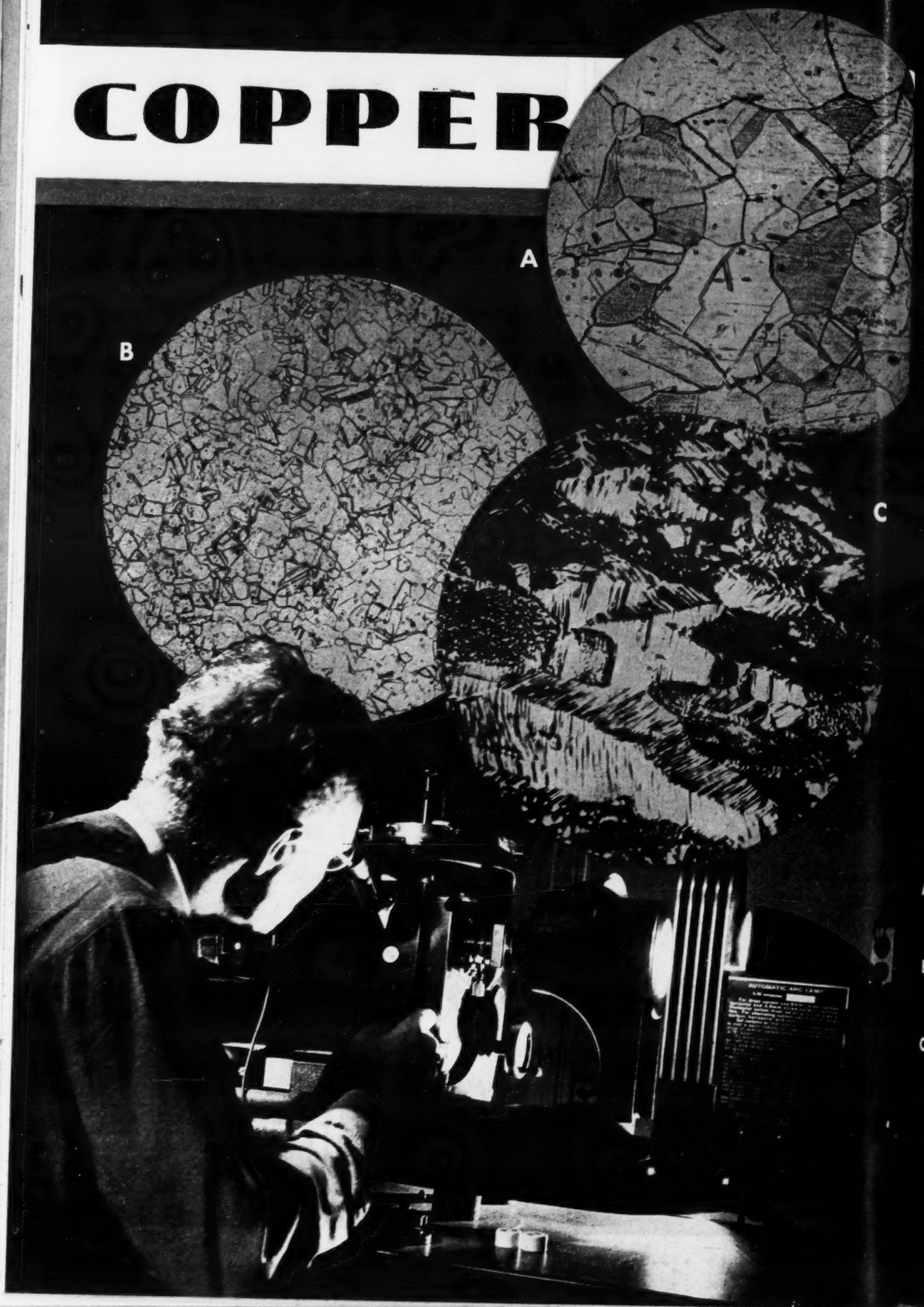
B Grain refinement of Hot Rolled Rod—X200

C Elongation of grains in longitudinal section of wire—X1500

GENERAL CABLE CORPORATION

Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

COPPER



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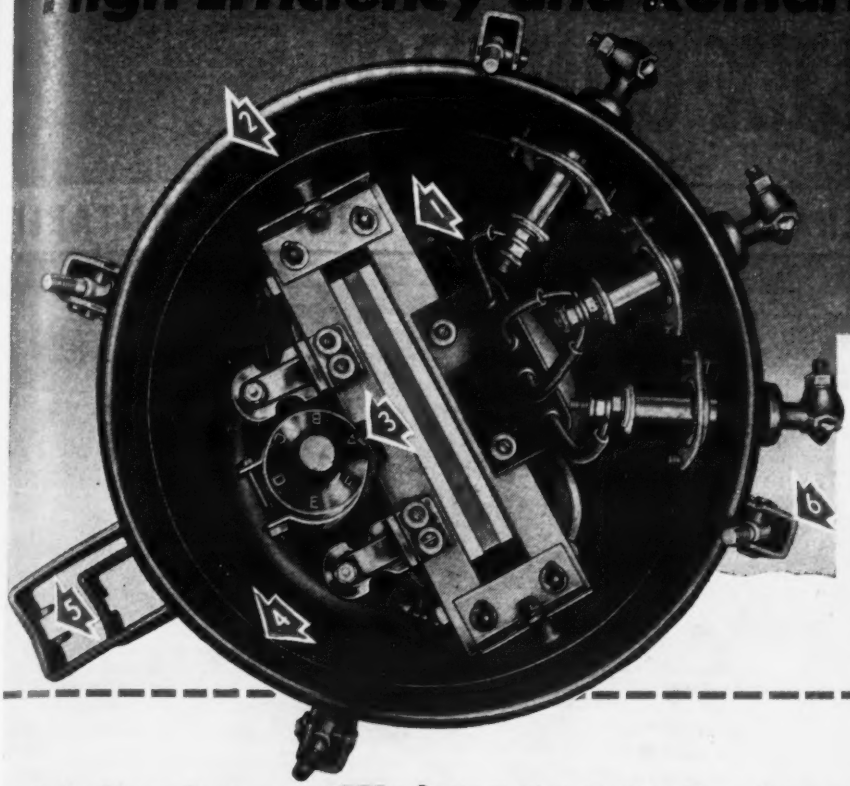
GENERAL CABLE CORPORATION

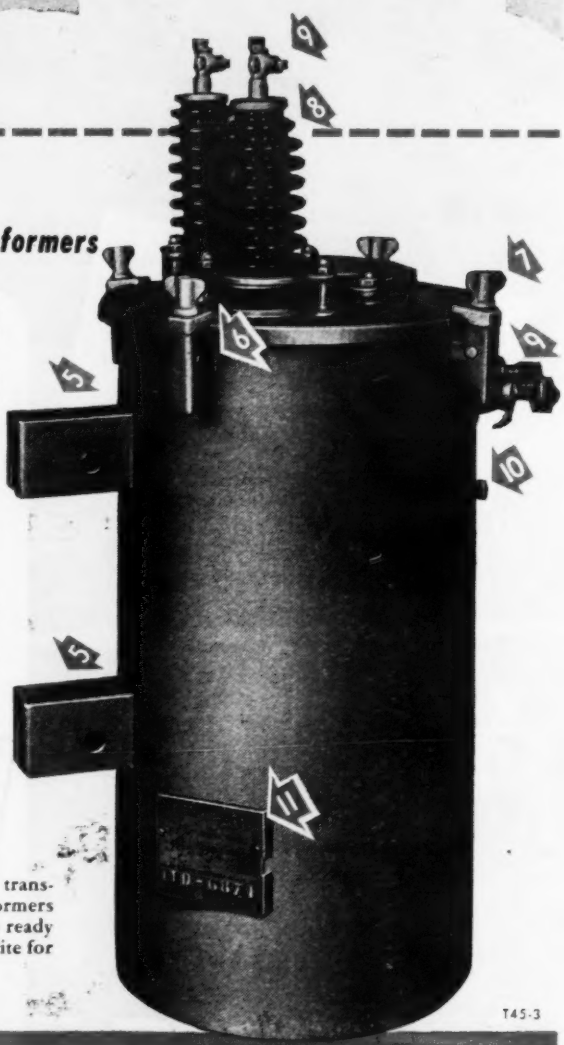
Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

QUADRUPLED Capacity
....AND THE LAST WORD IN EQUIPMENT...
War expansion quadrupled Formica's capacity both for production and machining of laminated plastics. It brought about the installation of the latest modern equipment, and the revision of procedure throughout the plant.
Now this giant capacity—by far the largest in the industry—this up-to-date equipment, and the trained man power to operate it, is ready for the service of industry in general.
It will make possible prompt delivery in quantity—flexible service, a high level of uniformity and accuracy in the material produced.
Among the new features of equipment: vertical treating machines with heat applied by infra-red lights; even cure of thick material by application of high frequency electronic heat; new types of tube rolling machines and many others.
THE FORMICA INSULATION COMPANY
4630 SPRING GROVE AVENUE
CINCINNATI 32, OHIO
FORMICA

High Efficiency and Remarkable Stamina are built into Wagner DISTRIBUTION TRANSFORMERS



...They embody the latest developments and meet all standard specifications...



Study These Features of Wagner Distribution Transformers

1. The core and coils of all Wagner distribution transformers are of the high-efficiency type, carefully wound, insulated, and treated to give years of uninterrupted service. Note liberal clearances on terminal boards and between element and tank.
2. Tank is of copper bearing sheet steel with all joints electrically welded. Top edge of tank is rolled to give added strength and to provide wide surface for cover gasket.
3. Snap-action tap changer with operating handle and position indicator above oil level. Because of the "snap action" it is impossible to leave tap changer open.
4. Plainly marked oil-level ring on inside of tank.
5. Standardized direct pole-mounting brackets. "T-crossarm Hangers" and "Kickers" are available for crossarm mounting.
6. Heavy, rugged lifting-lugs are solidly welded to the tank wall.
7. The cover can be easily removed by loosening the wing nuts and rotating the cover clamps.
8. Latest design stud-type bushings easily removed. Photo shows type HEBK with HV cover bushings, but type HEX is also available with HV pocket-type bushings.
9. Standardized solderless connectors on all bushing terminals.
10. Pads for grounding tank and LV neutral are provided.
11. Standardized nameplate pad with space for customer's identification plate located so as to be easily read from pole.

In addition to a complete line of distribution transformers, Wagner can also supply power transformers and unit substations. Wagner field engineers are ready to assist you in all transformer requirements. Write for complete literature.

TRANSFORMERS
are but one of several
WAGNER PRODUCTS

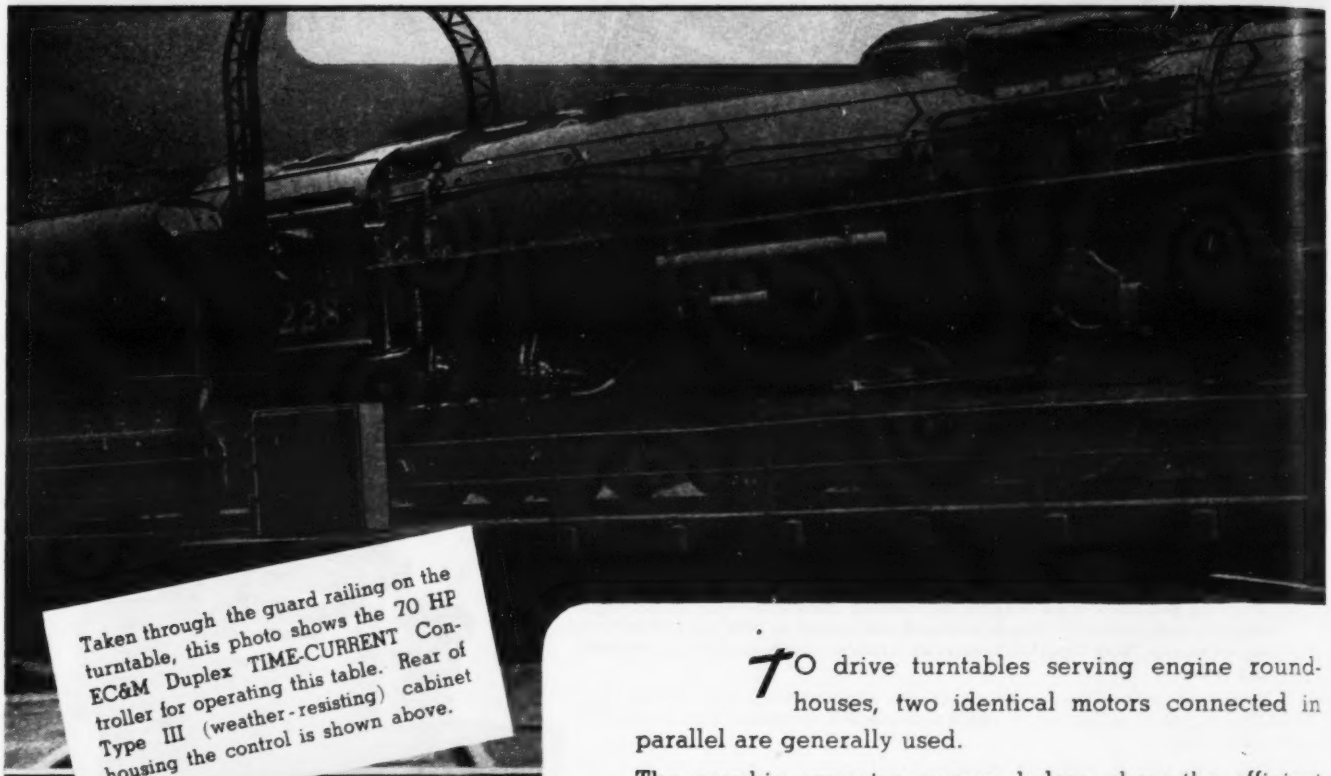
Other WAGNER PRODUCTS:
AIR BRAKES
•
BRAKE LINING
•
HYDRAULIC BRAKES
•
INDUSTRIAL BRAKES
•
INDUSTRIAL BRAKE CONTROLS
•
TACHOGRAPH
(Recording Speedometer)
•
ELECTRIC MOTORS

T45-3

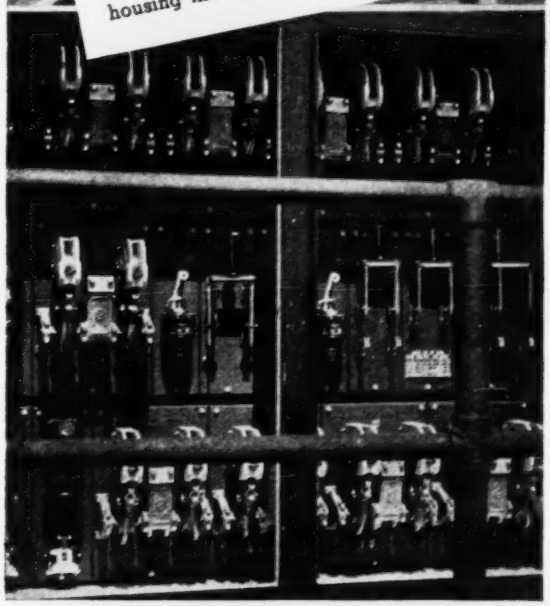
Wagner Electric Corporation
ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

EC&M
DUPLEX·CONTROL

ASSURES EFFICIENT OPERATION OF 2-MOTOR ENGINE-TURNTABLE

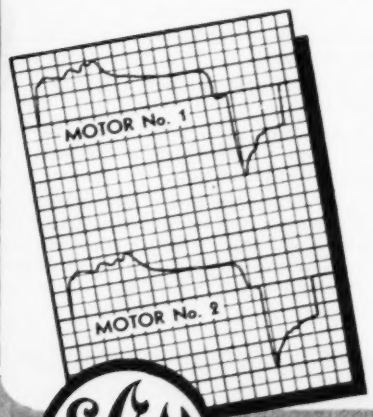


Taken through the guard railing on the turntable, this photo shows the 70 HP EC&M Duplex TIME-CURRENT Controller for operating this table. Rear of Type III (weather-resisting) cabinet housing the control is shown above.



To drive turntables serving engine roundhouses, two identical motors connected in parallel are generally used.

The graphic ammeter curves, below, show the efficient operation of these 2-motor drives obtained with EC&M Duplex Control. Superimposing one curve on top of the other shows that current values at any point on the curves—during starting, accelerating, running, or plugging—are practically duplicates of one another.



Duplex controllers are built for both a.c. and d.c. service. They are available, when desired, with transfer knife switches which permit isolation of either motor circuit for emergency single-motor operation. Complete information gladly furnished on request.

THE ELECTRIC CONTROLLER AND MANUFACTURING CO.

2698 EAST 79TH STREET · CLEVELAND 4, OHIO

why we say —

"LET'S WORK IT OUT TOGETHER"

At Dow, we firmly believe there is one *sure* answer to success in plastics. It's a simple, friendly idea—yet so important that we are setting aside this advertising space to tell you about it.

Our work with many manufacturers and molders all over the country has proved the value of close and continuing cooperation with them in developing nearly every job. As plastics move into a period of even greater usefulness, this teamwork becomes increasingly important; for putting plastics to work *right* is not a one-man job. It is not even a one-industry job. Instead, it calls for the combined skill and experience of manufacturer and designer—working step by step with molder—and Dow.

That's why we say *"Let's work it out together"*—it saves time and money and puts plastics in their right place.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

DOW PLASTICS INCLUDE:

STYRON (Dow Polystyrene) . . .
For moldings, extrusions, rods, sheets.

SARAN . . .
For moldings, extrusions, pipe, tubing, monofilaments; also available as Saran Film.

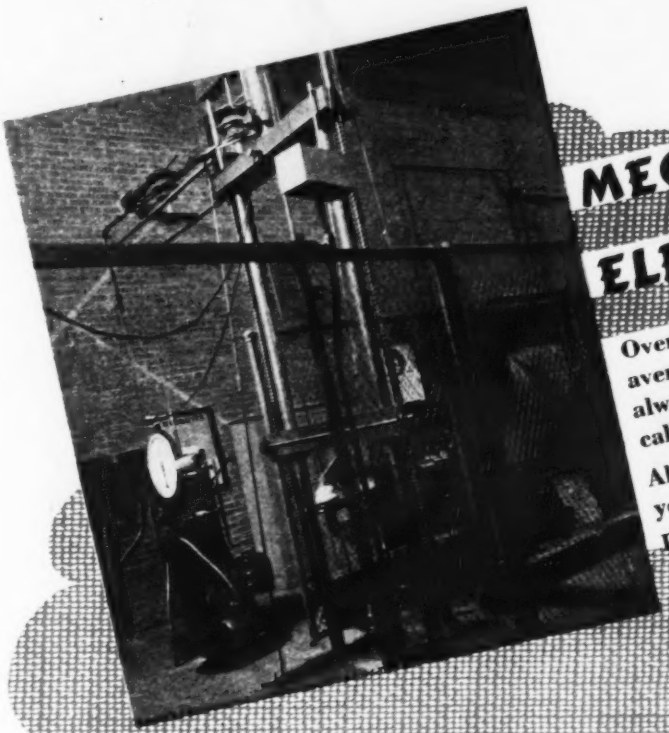
ETHOCEL . . .
For moldings, extrusions, coatings; available also as Ethocel Sheeting.

DOW
PLASTICS
Saran • Styron • Ethocel

✓ ✓ ✓ ✓ CHECK ALL

for present values and permanence . . . .

Every listed characteristic of a Locke Suspension insulator means something to you, in longer service life, lower maintenance and reduced construction costs. ***And these characteristics remain at the same high levels throughout the life of the insulator.***



MECHANICAL AND ELECTRICAL STRENGTH

Over twenty years ago Locke recognized the fallacy of average values. Locke Suspension Insulators have always given you something more than the specification called for.

All Locke published M&E values are minimum. For your convenience, this minimum M&E strength is plainly marked on the insulator cap.

FLASHOVER VALUES

Flashover values—particular the wet flashover—of an insulator string is an extremely important feature. Locke Suspension insulators are designed for the highest possible wet flashover value.

LOCKE *Insulator*

THE CHARACTERISTICS

IMPACT STRENGTHS

The particularly high impact strengths of Locke Suspension insulators save you money in many ways. In the first place, they make the units easy to handle faster without breakage in construction. Second, they reduce maintenance because they withstand severer mechanical and thermal shocks in service. And by discouraging vandalism, they lessen attempted malicious breakage.

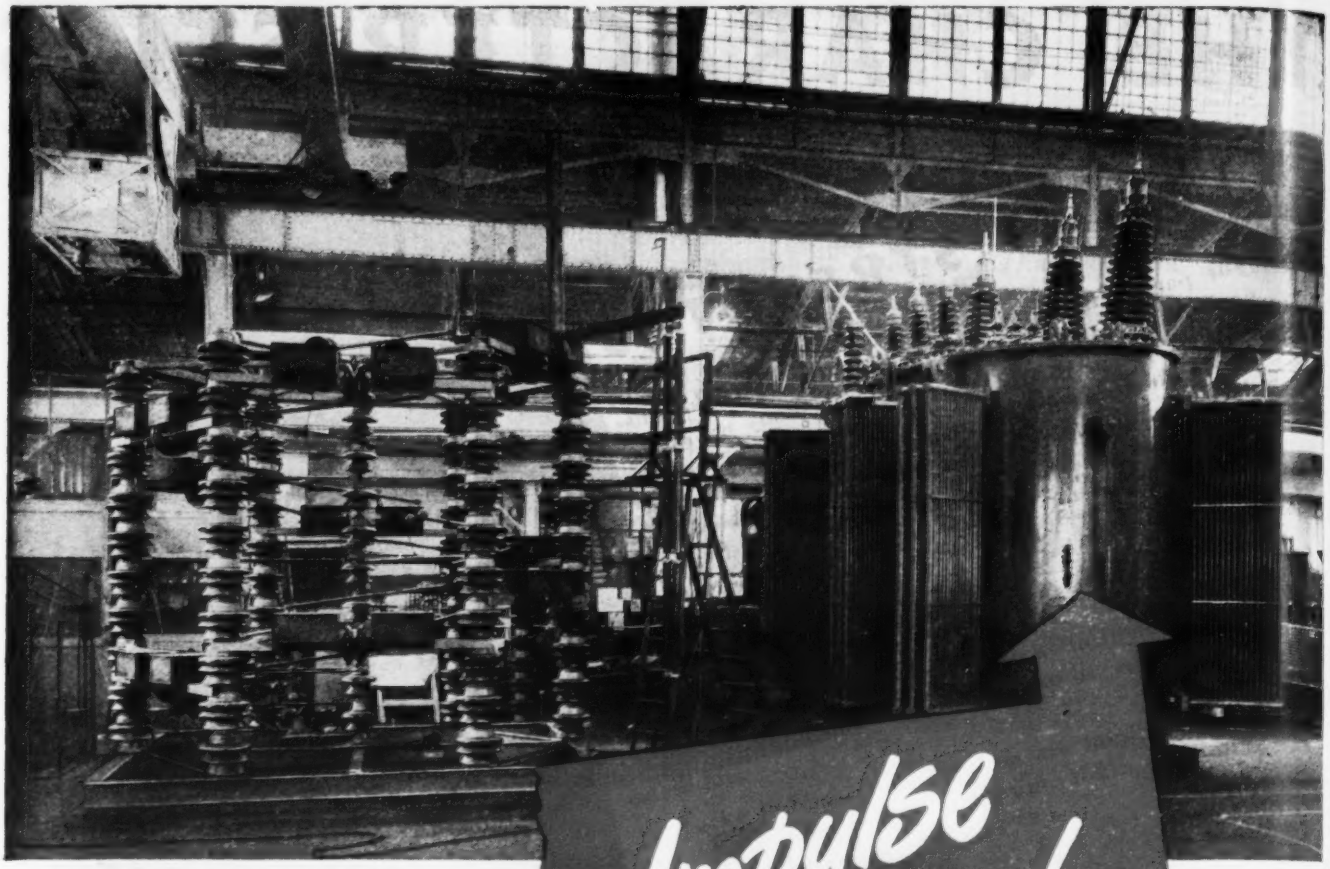
LEAKAGE DISTANCE

The provision of ample effective leakage distance was the primary consideration when Fred M. Locke, almost 60 years ago, designed his first insulator and it has been a primary factor in Locke design ever since.

Locke Suspension insulators not only give you ample leakage distance, but a designed leakage path which will stay clean and effective over longer periods.

These are the characteristics that determine the service you get from the insulators you buy. In the Locke plant exact controls are operating continuously 24 hours a day to properly maintain all these characteristics. How effective this control is can be gathered from the fact that no failures of Locke Suspension insulators due to other than outside influences are on record.

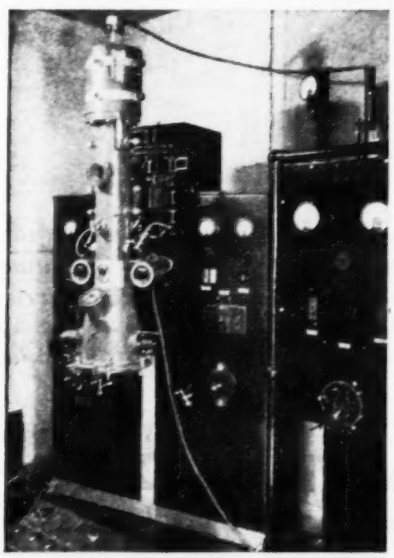
Corporation BALTIMORE MARYLAND



Testing a **PENNSYLVANIA**, 3 Winding, 138 Kv Power Transformer with an applied impulse test voltage of 750 Kv

Impulse Tested...

... to assure Reliable Performance!



Cathode-Ray Oscillograph with 60 Kv rectifier

Pennsylvania TRANSFORMER COMPANY has the engineering ability, research facilities and special plant equipment for building and testing all sizes and types of high voltage power transformers.

The impulse generator shown in the illustration is used for making impulse tests up to two million volts. It is equipped with a 150 Kv charging unit and a Cathode-Ray Oscillograph. This impulse testing equipment is used for both research and commercial tests.

Every Pennsylvania Transformer is designed to successfully meet impulse tests as well as other exacting requirements. This is but one of many reasons why Pennsylvania Transformers are known throughout the industry for their **reliability, longer life** and **lower maintenance.**

Pennsylvania TRANSFORMER COMPANY

808 RIDGE AVENUE, N. S., PITTSBURGH 12, PA.

1ST TEST OF A SERIES

Reliable proves that STRAIGHTLINE SPLICES AND DEAD ENDS

consistently GRIP and HOLD the full line wire strength

Your assurance of an extra margin of strength and service in Reliable Connectors, Splices and Deadends is the routine, accurate check of the physical properties of both the raw materials used and the finished product produced. Precise quality control insures a gripping surface much harder than the wire. Note the results of a routine Straightline Splice tensile test above.

Seeing is believing—watch for other test proof

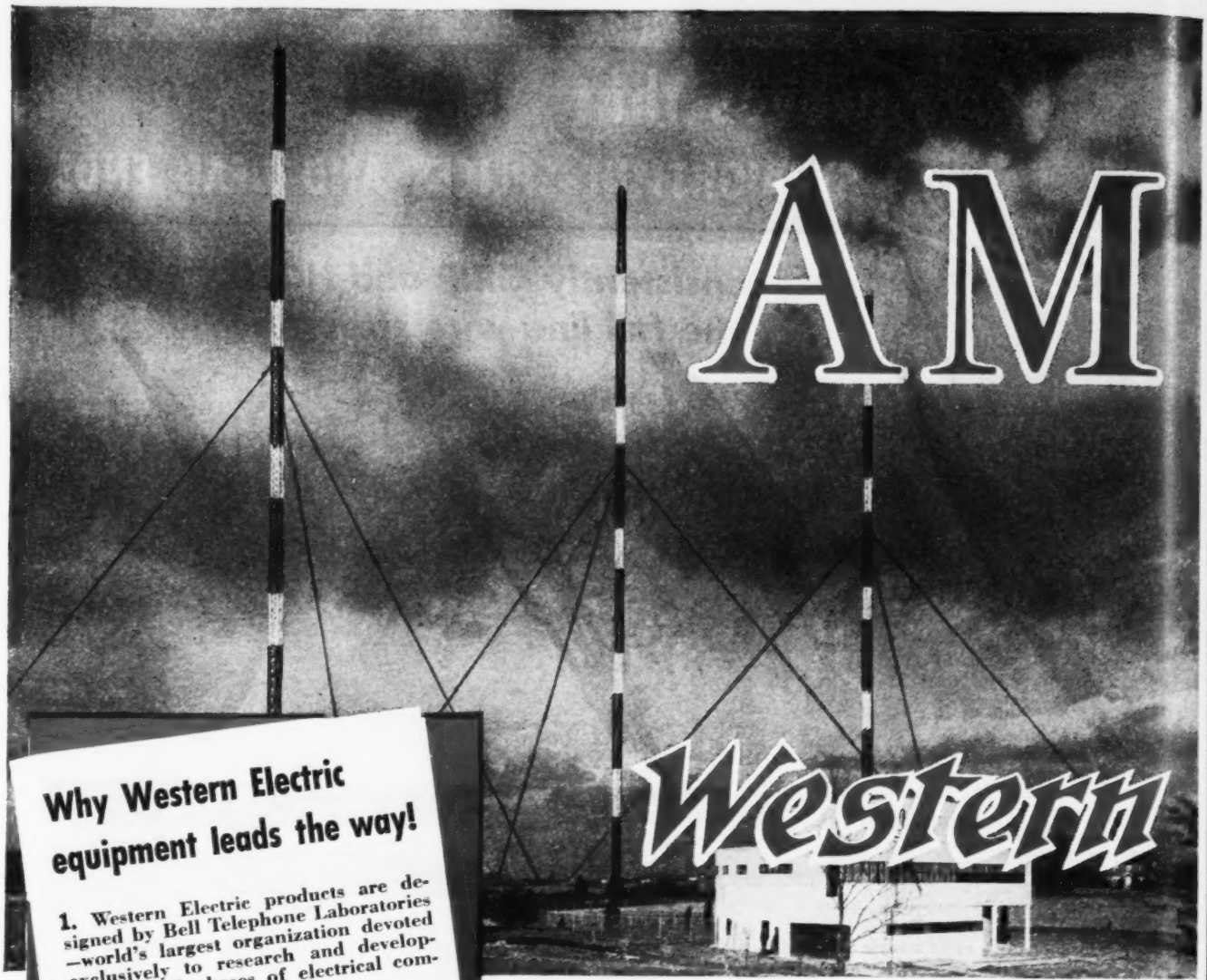
1. Gripping Test
2. Vibration Test
3. Corrosion Test
4. Conductivity Test

Above photograph shows laboratory technician testing hardness of gripping jaws of Reliable Straightline Splices

RELIABLE ELECTRIC COMPANY

3145 Carroll Avenue, Chicago 12, Illinois

OVER 35 YEARS SERVICE TO THE UTILITIES



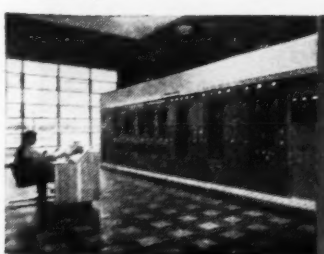
Why Western Electric equipment leads the way!

1. Western Electric products are designed by Bell Telephone Laboratories —world's largest organization devoted exclusively to research and development in all phases of electrical communication.

2. Since 1869, Western Electric has been the leading maker of communications apparatus. Today this company is the nation's largest producer of electronic and communications equipment.

3. The outstanding quality of Western Electric equipment is being proved daily on land, at sea, in the air, under every extreme of climate. No other company has supplied so much equipment of so many different kinds for military communications.

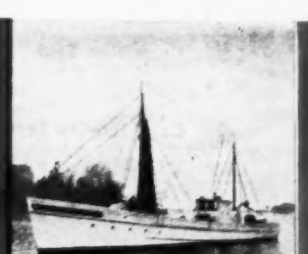
There can be no question that both AM and FM are slated for important jobs in the world of tomorrow—in broadcasting, aviation, mobile and marine radio. And Western Electric will offer you the finest equipment of each type—backed by 76 years of leadership in making communications apparatus for almost every purpose.



BROADCASTING

AVIATION RADIO

MOBILE RADIO



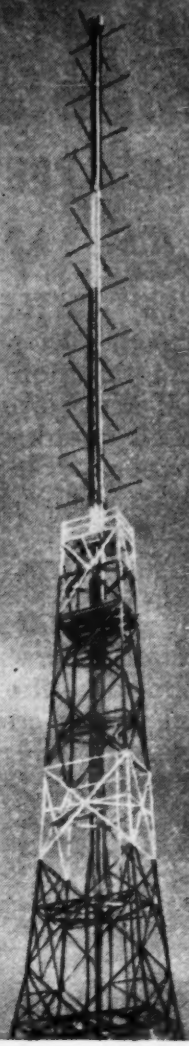
MARINE RADIO

Western Electric has specialized

or FM

Electric

equipment leads the way!



As a result of intensified wartime research at Bell Telephone Laboratories, of improved manufacturing techniques and increased production facilities at Western Electric, many new things are now being produced which will have peacetime applications.

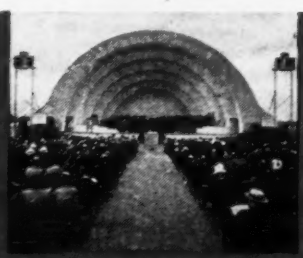
In the years of progress that lie ahead for radio, count on Western Electric to lead the way!

Western Electric

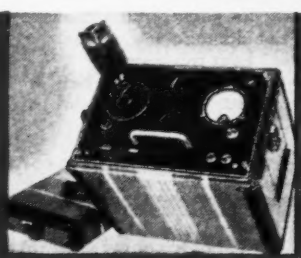
Distributed by GraybaR ELECTRIC COMPANY

Buy all the War Bonds you can . . . and keep all you buy!

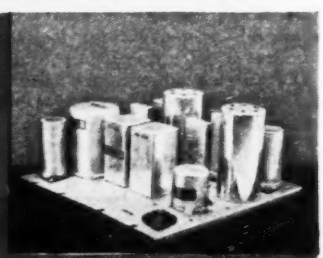
TELEVISION



SOUND SYSTEMS

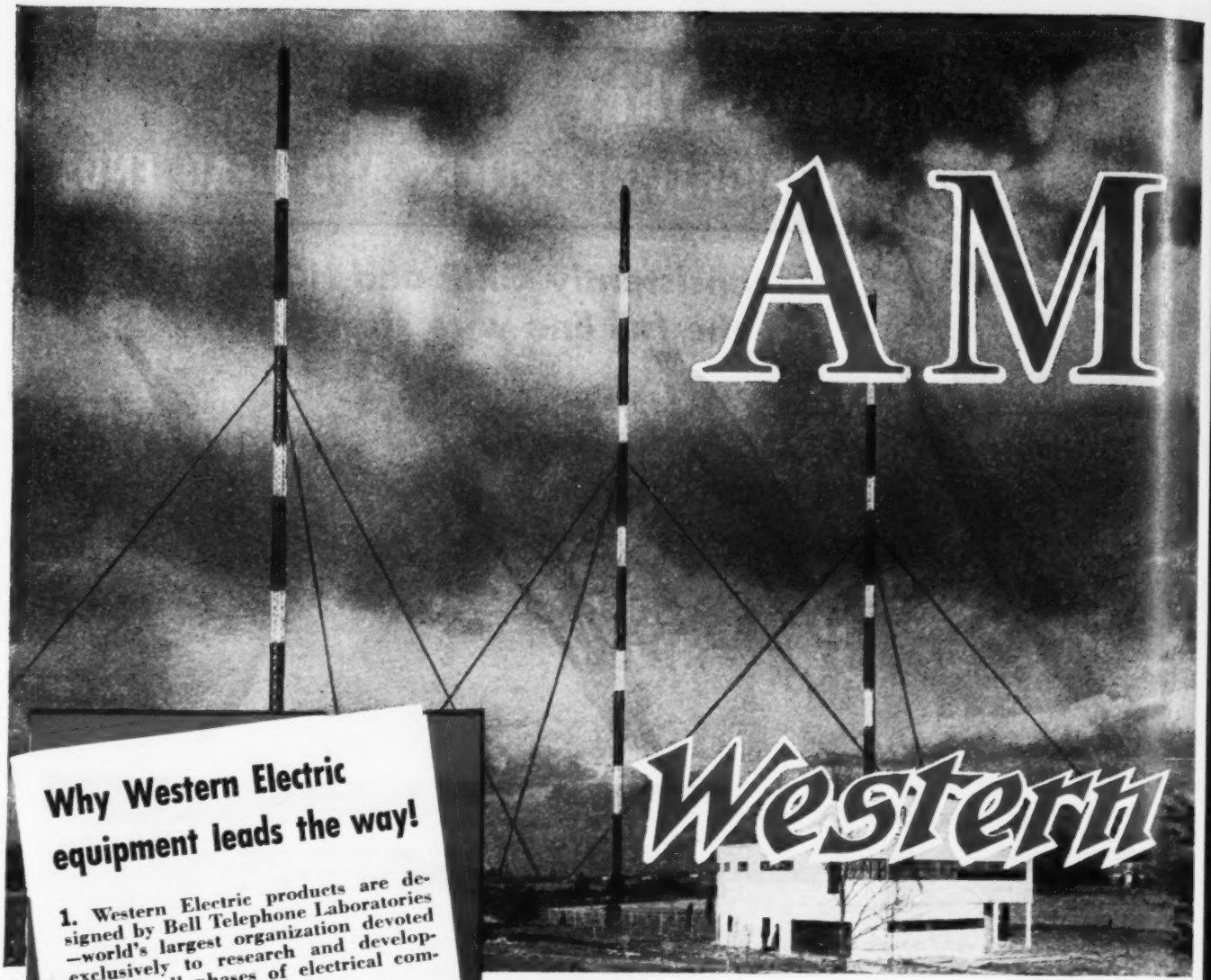


ACOUSTIC INSTRUMENTS



COMPONENT PARTS

knowledge in all of these fields



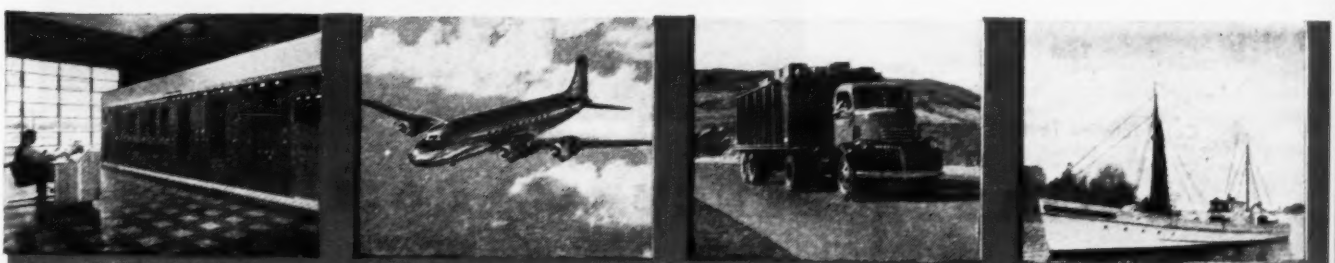
Why Western Electric equipment leads the way!

1. Western Electric products are designed by Bell Telephone Laboratories —world's largest organization devoted exclusively to research and development in all phases of electrical communication.

2. Since 1869, Western Electric has been the leading maker of communications apparatus. Today this company is the nation's largest producer of electronic and communications equipment.

3. The outstanding quality of Western Electric equipment is being proved daily on land, at sea, in the air, under every extreme of climate. No other company has supplied so much equipment of so many different kinds for military communications.

There can be no question that both AM and FM are slated for important jobs in the world of tomorrow—in broadcasting, aviation, mobile and marine radio. And Western Electric will offer you the finest equipment of each type—backed by 76 years of leadership in making communications apparatus for almost every purpose.



BROADCASTING AVIATION RADIO MOBILE RADIO MARINE RADIO

Western Electric has specialized

or FM

Electric
equipment leads the way!

As a result of intensified wartime research at Bell Telephone Laboratories, of improved manufacturing techniques and increased production facilities at Western Electric, many new things are now being produced which will have peacetime applications.

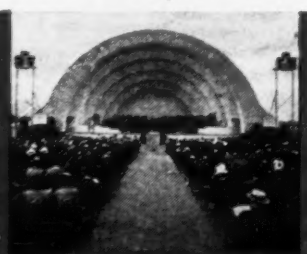
In the years of progress that lie ahead for radio, count on Western Electric to lead the way!

Western Electric

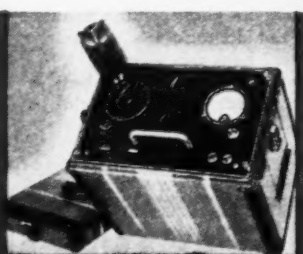
Graybar Distributed by Graybar Electric Company

Buy all the War Bonds you can . . . and keep all you buy!

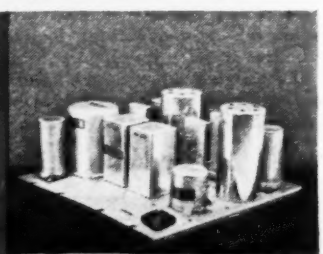
TELEVISION



SOUND SYSTEMS



ACOUSTIC INSTRUMENTS



COMPONENT PARTS

knowledge in all of these fields

A NEW COMBINATION Manhole Oil Switch with

AIR BREAK PORCELAIN ENCLOSED DISCONNECTS

G & W

TYPE "PK" - STYLE "ES"

7500 Volts — 400 Amperes

The combination unit provides full load break under oil with air break disconnection between cable and load to comply with safety rule requirements.

The use of style "ES" porcelain enclosed disconnects makes it possible to change phase connections if necessary to balance the load.

The oil switch can be padlocked to prevent unauthorized operation.

NO ARCING TIPS

The simplicity and effectiveness of high pressure contacts is incorporated in the G & W Type "PK" link design. The link is a heavy copper casting, ball shaped at each end to fit into the upper grooved contacts. The two coil springs in each link exert a pressure of 125 pounds. The links are self-aligning.

No arcing tips are necessary because the slight pitting that occurs when breaking full load does not damage the contact surfaces. (Proven by "before" and "after" heat run tests.)

The tapered holes in the balls force oil in-between the ball and groove while the switch is being opened. This oil circulation quickly quenches any arcing.

The switch chassis is removable as a unit from the tank. The square end of the internal operating shaft fits into a grooved inside end of the external shaft. Chassis can be inserted into the tank only in the "OFF" position. The unit is held in place by three guide rods with nuts. The porcelains are individually detachable.

Style "ES" porcelain cap with disconnecting plug. Note internal expanding springs in plug to maintain high pressure contact.

Write us or our nearest representative for further data.

G&W ELECTRIC SPECIALTY CO.

7780 DANTE AVE., CHICAGO 19, ILL., U. S. A.

Also made in Canada by Powerlite Devices, Ltd., Toronto

G&W ELECTRIC SPECIALTIES

Originators and pioneers of equipment for sound methods of underground and overhead electric distribution.

Potheads . . . Boxes . . . Oil Fuse Cutouts . . . Oil Switches . . . Multiple Circuit Disconnects

More Light on the TRUE cost of FLUORESCENT LIGHTING

in stores, offices, schools and public buildings

THERE is but one way to "figure" *any* lighting system: The *total* cost, fully installed and ready to operate.

"Fixture" cost is but part of the total cost. Unless the *composite* costs of conduit, wire, wiring and other installation and mounting materials are also taken into full account, the *true* cost may be a sad surprise.

In designing fluorescent lighting systems, The Miller Company has done something about that fundamental point:

1. **The number of supports needed to hang Miller lighting equipment has been reduced 50 to 75%.**
2. **Moving of outlets has been minimized or, in many cases, *eliminated*.**
3. **Wiring costs have been reduced up to 50%.**
4. **Conduit and conduit fitting costs have been reduced up to 80%.**
5. ***New ceiling furring systems, made possible by the patented Miller Bracket, provides a stronger structural ceiling, simplifies and speeds up the entire construction.***

To the foregoing brass tacks, add these facts:

1. **Miller Fluorescent Lighting Systems are backed by 100 years' experience with all proven light sources.**
2. **These systems present new vistas in esthetic design and functional planning.**
3. **They are amazingly versatile and fit the picture as single units or in blocks, geometric patterns and even as light strips "by the mile".**
4. **Their wide range of plastic and glass plates, prismatic glass lenses and metal or plastic grilles harmonize with any interior—or, in their many possible arrangements, suggest themes around which entire interiors may be planned.**

It all adds up to the simple GRAND total fact that calling a Miller Representative (they're in principal cities) may be your happy answer to a lot of problems!

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

The Buckeye Laboratories Corpora.
2890 East 83rd St.
Clevelana, Ohio

Gentlemen:

We believe that your equipment can correct an oil problem with which we are troubled.

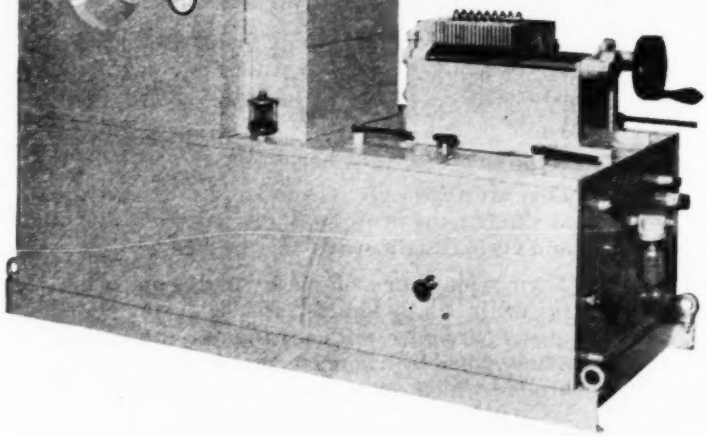
Although the oil has a high dielectric, we have water, in solution in the oil, that a centrifuge or blotter press will not remove. The water condenses on the cold cover as globules and falls back onto the windings. Our oil has a relatively low acid content, free from sludge;

THE PROBLEM

THE ANSWER

THE HYDROVOLIFIER

This inquiry from a large utility is typical of many we receive. The Hydrovolifier has been successful in correcting many similar conditions—because it removes all water, both free and in solution, from the oil. Here's how it's done. The oil is forced through atomizing nozzles into a vacuum chamber. This treatment transforms all water (both free and in solution) into vapor which is drawn off and discharged.



The Hydrovolifier is also being used successfully to remove volatile (corrosive) acids—sludge and other impurities.

Available in three standard sizes.

HV—100—Capacity 100 gal. per hour
HV—300—Capacity 300 gal. per hour
HV—500—Capacity 500 gal. per hour

BUCKEYE
LABORATORIES CORPORATION

1965 E. 66th St.
CLEVELAND 3, OHIO

For further details, consult a nearby representative.

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OAKLAND—GEORGE A. KUSHMAN CO., 428 13th Street, Oakland 12, California

CONDULETS

are made only by CROUSE-HINDS

The Crouse-Hinds Company introduced the first cast electrical conduit fitting that was ever manufactured. Identified by the Crouse-Hinds trade name, **CONDULET,** this fitting was so well designed that it quickly revolutionized electrical conduit installation practice. Today, the complete CONDULET line, greatly expanded and improved, is still the Standard of Quality in the field of electrical conduit fittings.

The WEDGENUT fastener, an exclusive Crouse-Hinds feature, is part of the cover. Screws can't fall out. No screw holes to locate. When tightened by the WEDGENUT fastener, the cover automatically seats itself, firmly contacting entire surface of cover opening.

The Obround CONDULET was the original cast electrical conduit fitting. Today's improved CONDULETS have quality features not found in any other conduit fitting.

Taper Tapped Threads, an important Crouse-Hinds feature. The threads on tapered conduit bear against every thread in the hub of a taper tapped CONDULET. This provides the most rigid joint, not affected by vibration. Assures permanent ground continuity.

CONDULETS are made only by Crouse-Hinds and every genuine CONDULET bears the Crouse-Hinds trade name, **CONDULET,** or the Crouse-Hinds trade-mark.

When a gasket is used, you have a thoroughly **Weatherproof** enclosure.

Obround CONDULETS are a large and useful Series in the big CONDULET family. There are **49** different Obround Types listed in CONDULET Catalog No. 2500, Section 5. Sizes to fit ⅛" to 6" conduit. Three styles of hubs: for thick wall threaded conduit; for thick wall threadless conduit; for thin wall threadless conduit (electrical metallic tubing). In addition to plain covers, a variety of wire hole, switch, and receptacle covers are available.

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
SYRACUSE 1, N. Y., U.S.A.

Offices: Birmingham—Boston—Chicago—Cincinnati—Cleveland—Dallas—Denver—Detroit—Houston—Indianapolis—Kansas City—Los Angeles—Milwaukee—Minneapolis New York—Philadelphia—Pittsburgh—San Francisco—Seattle—St. Louis—Washington. *Resident Product Engineers:* Albany—Atlanta—Charlotte—New Orleans
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

a rolling stone gathers no moss

and unreliable insulation on your appliances gathers no friends. Macallen is a synonym for reliability in electrical insulation. For over 50 years we have specialized in processing Mica into the most efficient forms of insulation obtainable.

When you think of MICA think of MACALLEN

the Macallen Company

16 MACALLEN STREET - BOSTON 27

CHICAGO: 545 W. Washington Blvd. CLEVELAND: 1005 Leader Bldg.

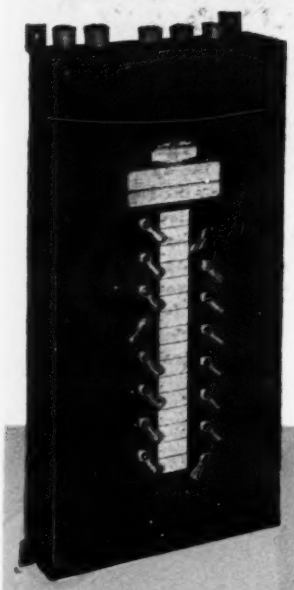
Above: (FA) Dust-tight Power Panelboard with 225 and 600 Amp Frame Circuit Breakers.

Where DUST is a HAZARD

exposed arcs may set off disastrous explosions. Guard against this danger by installing

(FA) DUST-TIGHT Light and Power PANELBOARDS

Below: (FA) Dust-tight Lighting Panelboard and Cabinet for wall or exposed column mounting.



They are approved by Underwriters' Laboratories, Inc., for "Class II, Groups F and G, Hazardous Locations." This includes coal mines, coal processing plants, shell-loading plants, grain mills, and other places where dust is a dangerous factor.

These panelboards have a solid steel front plate, gasketed all around, and secured with screws to an extra wide box flange. They are further rendered dust-tight with welded hubs for conduit outlets, welded box corners, and handle bushings riveted directly to the steel cover plate. External mounting brackets are provided, to maintain the dust-tight construction.

The circuits are externally operated by a mechanism of new (FA) design. The handles operate through dust-tight bushings, and engage the regular handles of the circuit breakers inside the cabinet. ON and OFF positions are indicated on the front of the cabinet.

(FA) Dust-tight Panelboards are of the circuit breaker type. Capacities of Power Panels: 15 to 600 amperes, 250 volts AC or DC, and 600 volts AC. Lighting Panels, standard or narrow column type, equipped with (FA) Type AC Thermag or (FA) Dublbrak Circuit Breakers (or other types of ranch-circuit circuit breakers). Available with 4 to 42 circuits, 50 amperes or less, for 3 wire, single phase, or 4 wire, 3 phase mains, with lugs only, or main breaker.

Write for Bulletin 67

which contains descriptions, sizes, capacities, wiring diagrams, prices and suggested specifications . . . Frank Adam Electric Company, Box 357, St. Louis 3, Mo.

The same form of construction but with rubber (or equivalent) type of gasket is available for VAPOR PROOF installation.

Frank Adam
ELECTRIC COMPANY
ST. LOUIS

We control the quality of

CENTRAL RIGID STEEL CONDUIT

. . . because it is made in our own mills, from time tested Spang pipe.

"There's Tested Strength in Every Length"

The operation above is the Flash-welding, end to end, of steel strip into an endless steel strip preparatory to heating, forming, and welding into Continuous Weld Pipe, which is further processed into finished CENTRAL Conduit.

SPANG-CHALFANT

Division of The National Supply Company

General Sales Office: Grant Building, Pittsburgh 30, Pa.

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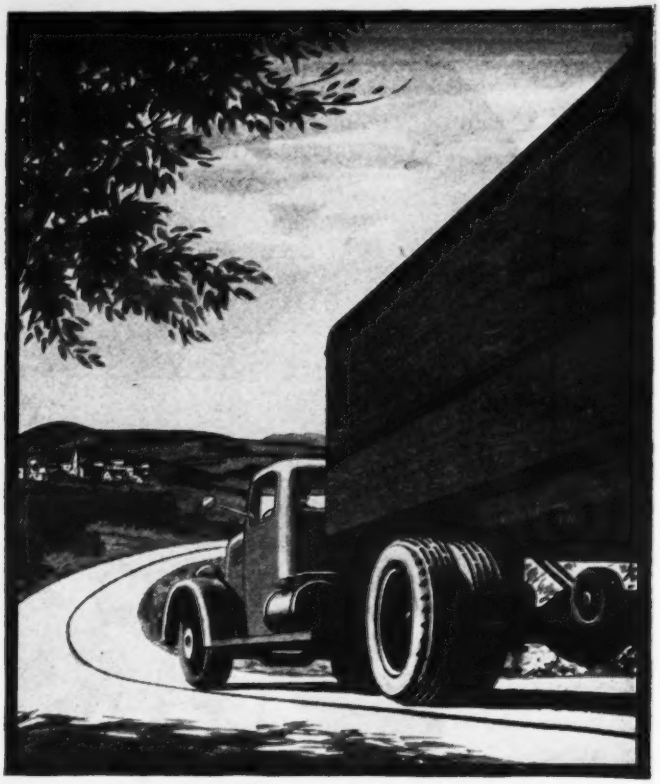
For a Quick Recovery



"Quick Recovery" is the job of the Heavy Wreckers built by Ward LaFrance for the armed forces. When a tank, truck, or half-track is put out of action, these rugged trucks go out and get them. They bring 'em back through sand, muck and rocky terrain, over nearly impossible trails or, often enough, cross country.

Using this equipment, a Rigger-Wrecker graduating class at the O.R.T.C., Aberdeen Proving Ground, hung up an unchallenged speed record by recovering an overturned five-ton truck from a deep ditch in three minutes and 28 seconds, under simulated battle conditions.

If your fleet has suffered from lost tonnage due to wartime lack of trucks, Ward LaFrance trucks are the best prescription for quick postwar recovery. Whether your needs call for dump trucks, over-the-road tractors (gasoline or Diesel), or vehicles engineered to your individual needs, Ward LaFrance offers your best profit opportunity: . . . A plan developed particularly for fleet owners makes it possible for you to take full advantage of the rugged power and dependability of Ward LaFrance trucks on a basis which will cut the cost of transportation to the bone.

WARD LAFRANCE

TRUCK DIVISION

GREAT AMERICAN INDUSTRIES, INC.

ELMIRA, GAI **NEW YORK**

PLANNING POSTWAR POWER?

Two steam power plants are seldom the same. Usually, each has its special set of requirements and operating conditions. These will govern the equipment selected. But there *are* certain *basic* principles, common to all, governing the *type* of equipment. They've been evolved through experience—and tested in use.

Whether you're building a new plant or expanding an old one, these principles will serve as a valuable guide for your functional planning. Westinghouse, builder of the majority of products in a modern power plant, is well qualified and ready to place this information at your disposal.

Westinghouse

PART ONE

GETTING STARTED

Types of Turbines
Sizes of Turbines
Turbine Speeds

PART TWO

PERFORMANCE DATA

Basic Operating Conditions
Deviations in Operating Conditions
Approximate Over-All Dimensions
Recommended Condenser Sizes
Choice of Condenser Size
Condenser Data Charts
Condenser Dimensions
Condenser Friction
Circulating Pumps
Condensate Pumps
Other Auxiliaries

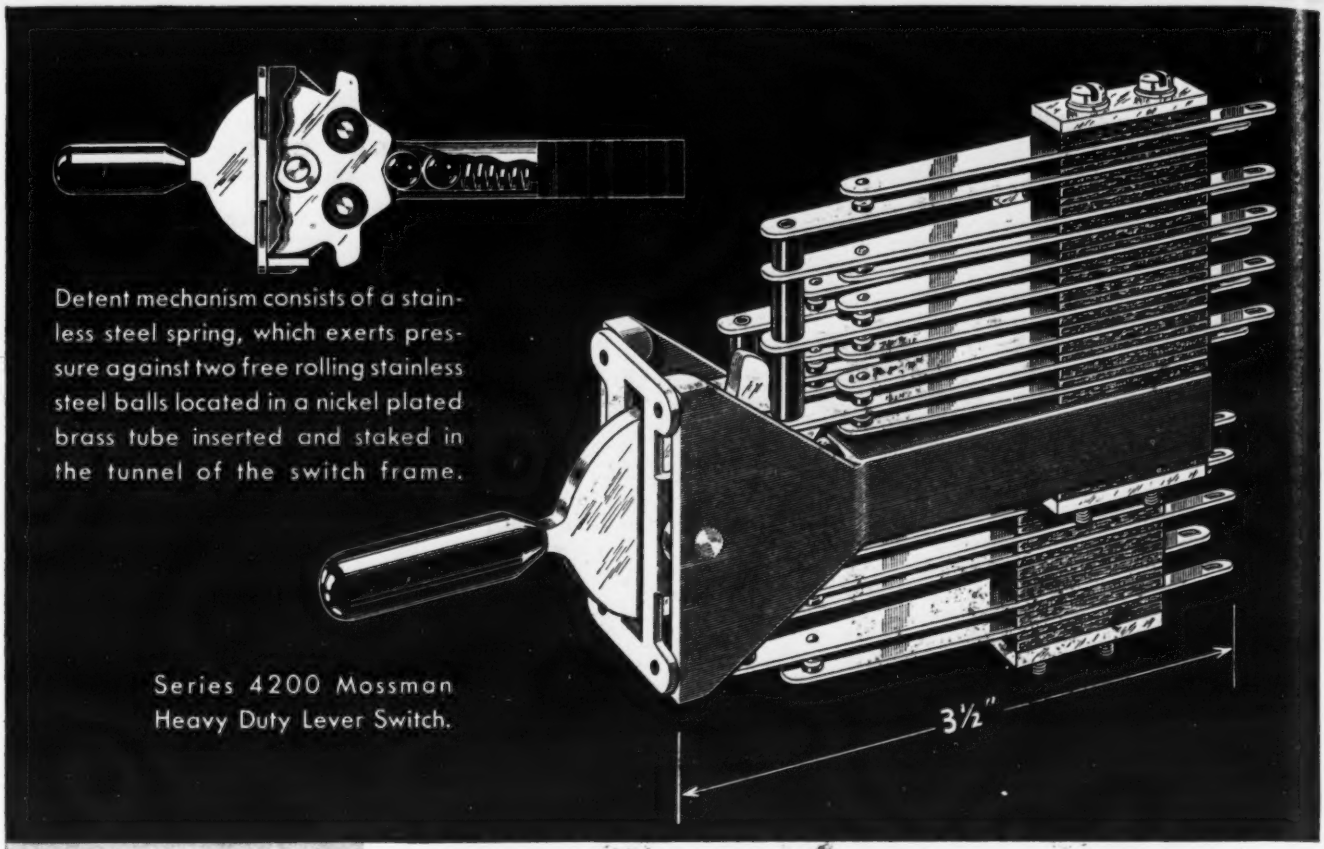
THEN YOU NEED THIS BOOK

This new Westinghouse Steam Power Plant Planning Guide contains basic information about condensing-type turbines from 10,000 kw to 60,000 kw . . . and the condensers suitable for them. Using this Planning Guide, you'll be able to trace the functional plan of your plant.

For a copy of this valuable new planning book, call your nearest Westinghouse Office. No obligation, of course. Westinghouse Electric & Manufacturing Company, Box 868, Pittsburgh 30, Penna.

J-50457

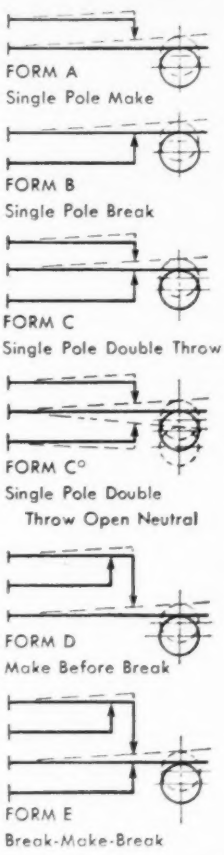
Steam Headquarters



Detent mechanism consists of a stainless steel spring, which exerts pressure against two free rolling stainless steel balls located in a nickel plated brass tube inserted and staked in the tunnel of the switch frame.

Series 4200 Mossman Heavy Duty Lever Switch.

BASIC CONTACT FORMS



MOSSMAN SERIES 4200 PACKS A LOT OF SWITCH INTO SMALL SPACE

Utility engineers who are looking for a compact, light-weight switch for locations where inches and ounces are of prime importance, will find the new Mossman Series 4200 Heavy Duty Lever Switch will meet their requirements.

With a frame of aluminum die casting to keep weight to a minimum, the Series 4200 Switch extends but 3½ inches behind the panel.

Yet, with all its compactness, this lever switch is a rugged, positive action switch with a detent mechanism which cannot be thrown out of position by either jar or vibration.

Series 4200 Mossman Lever Switches are available as either three position . . . with locking action in the neutral or center position and locking or non-locking in the other two positions; or two position with locking action only in both.

Making use of any combination of the six basic forms shown here, the Series 4200 Lever Switch is capable of almost unlimited circuit arrangements. Utility engineers find it most useful in such applications as indication in remote control of telemetering circuits, supervisory control circuits in load dispatching, communication control circuits, testing and calibration in meter departments and for tube testing.

Contacts of the Mossman Series 4200 Switches are: Standard heavy duty . . . ⅛" diameter fine silver, rated at 5 amperes, 110 volts A.C., non-inductive. Extra heavy duty: 3/16" diameter fine silver, rated at 10 amperes, 110 volts A.C., non-inductive.

For complete information on the Mossman Series 4200 Heavy Duty Lever Switches and the complete line of Mossman precision electrical components, send for the Mossman Catalog. In its pages you will find many types of heavy duty lever switches, turn switches, push switches, plug jacks and other special switching components.

DONALD P. MOSSMAN, INC., 612 N. Michigan Ave., Chicago 11, Ill.

MOSSMAN

Electrical Components

America's Foremost Family of Alloys

AT YOUR SERVICE FOR 45 YEARS

Best proof of the superiority of D/H Alloys lies in the record. For 45 years, Driver-Harris has been the foremost producer of an internationally recognized group of alloys.

Best known member of this famous alloy family is NICHROME*—most widely used of all resistance alloys. No less renowned and equally preferred in their specialized fields are the more than 80 other D/H Alloys.

Underlying this preference is the quality plus factor in every D/H Alloy assured by the high degree of metallurgical control that enters into their manufacture from furnace to spool. Therefore, to insure longer life and improved performance in your product, send your metal specifications to us and depend on it . . . Driver-Harris will supply the alloy possessing the best electrical and physical properties for your requirements.

D/H
SPECIAL PURPOSE ALLOYS SINCE 1888

Driver-Harris COMPANY

HARRISON, N. J.

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ARMY NAVY

FOR ELECTRICAL RESISTANCE

NICHROME*
NICHROME*V
ADVANCE*
HYTEMCO*
CHROMAX*
MAGNO*
MIDOHM*
COMET*
LUCERO*
MANGANIN
11 ALLOY
30 OHM ALLOY
LOHM*
90 OHM ALLOY

FOR HEAT OR CORROSION RESISTANCE

NICHROME*
NICHROME*V
NICKEL A†D†E†Z†
CIMET*
MONEL†
K-MONEL†
R-MONEL†
D/H STAINLESS STEELS
INCONEL†

FOR RADIO SETS AND TUBES

NICHROME*
NICHROME* V
NICHROME* 111
GRIDNIC A-B-C-D-E-F*
RADIOHM*
MANGANIN
ADVANCE*
52 ALLOY
FILAMENT ALLOYS
D/H STAINLESS STEELS
NICKEL A†D†E†
MONEL†
42 ALLOY
NILVAR*

FOR SPARK PLUG APPLICATION

MAGNO*
R-63 ALLOY
SPECIAL NICKEL ALLOYS

In addition to the above genera classifications many other industrie are served by Driver-Harris Alloys Space does not permit listing them all

*Trade Mark Reg. U.S. Pat. Off. by Driver-Harris

†Trade Mark Reg. U.S. Pat. Off. by The International Nickel Company, Inc.

WHAT HAS OTIS ELEVATOR COMPANY BEEN DOING?

...and what are they PREPARED to do?

The factories of the Otis Elevator Company have been devoted one hundred per cent to the war effort. That's not unique. That's the pattern of American industry.

however...

In addition to our large scale production of a great variety of highly precise mechanisms of war for the Army, Navy, and the Air Corps, we have continued to produce elevators. We have manufactured freight as well as passenger elevators for hospitals, ordnance depots, naval warehouses, and other priority installations.

this means..

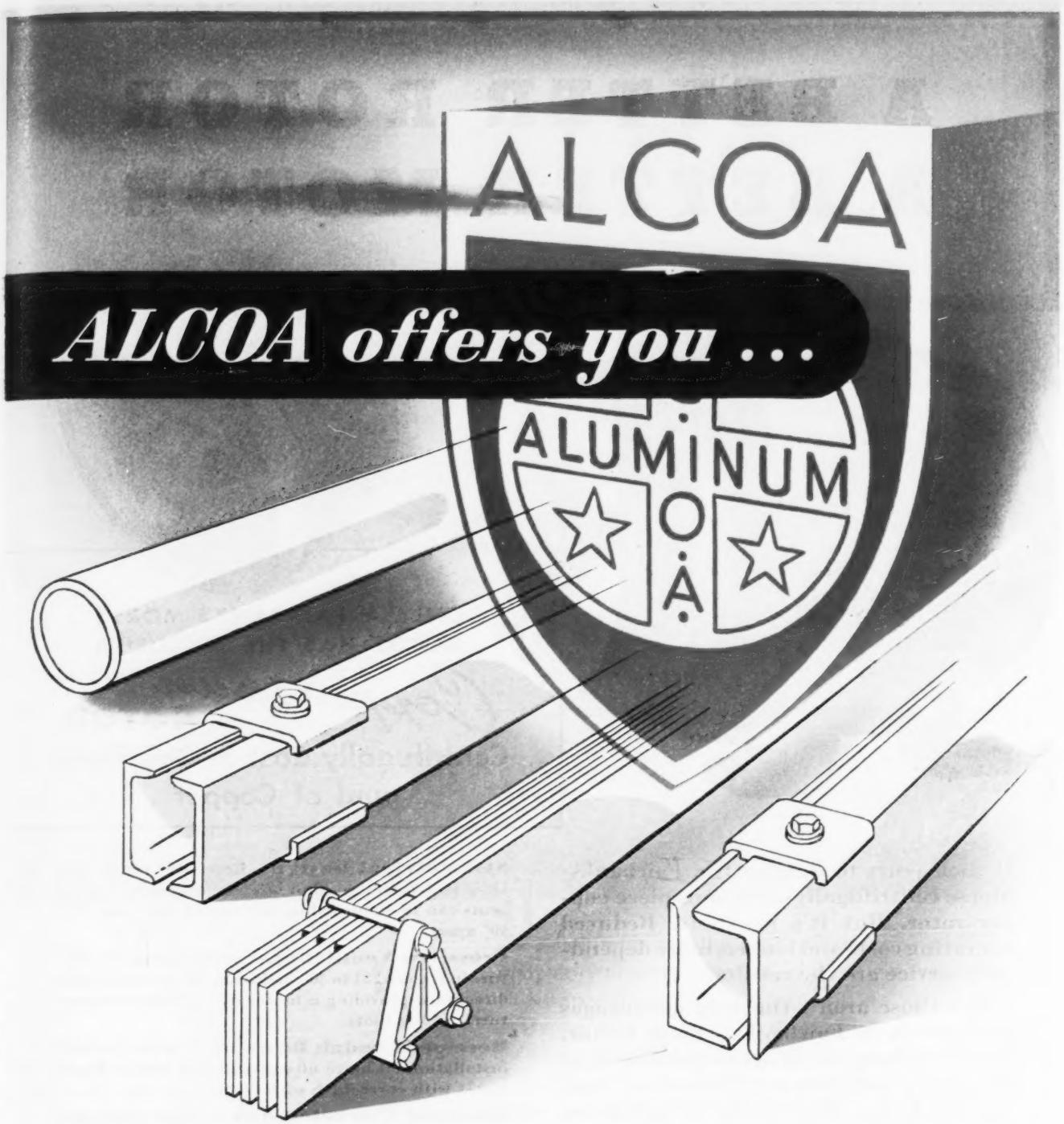
Although our facilities, organization, and resources have enlisted for the duration and have gone all out for war production *as a matter of actual fact we have never been out of the business of manufacturing, installing, and servicing elevators.*

and so...

As our war work is reduced or terminated, this company is prepared — with no change in pace, and without missing a stride — to resume furnishing the highest quality elevators and escalators for all peacetime purposes.

Otis ELEVATOR COMPANY

OFFICES IN ALL PRINCIPAL CITIES

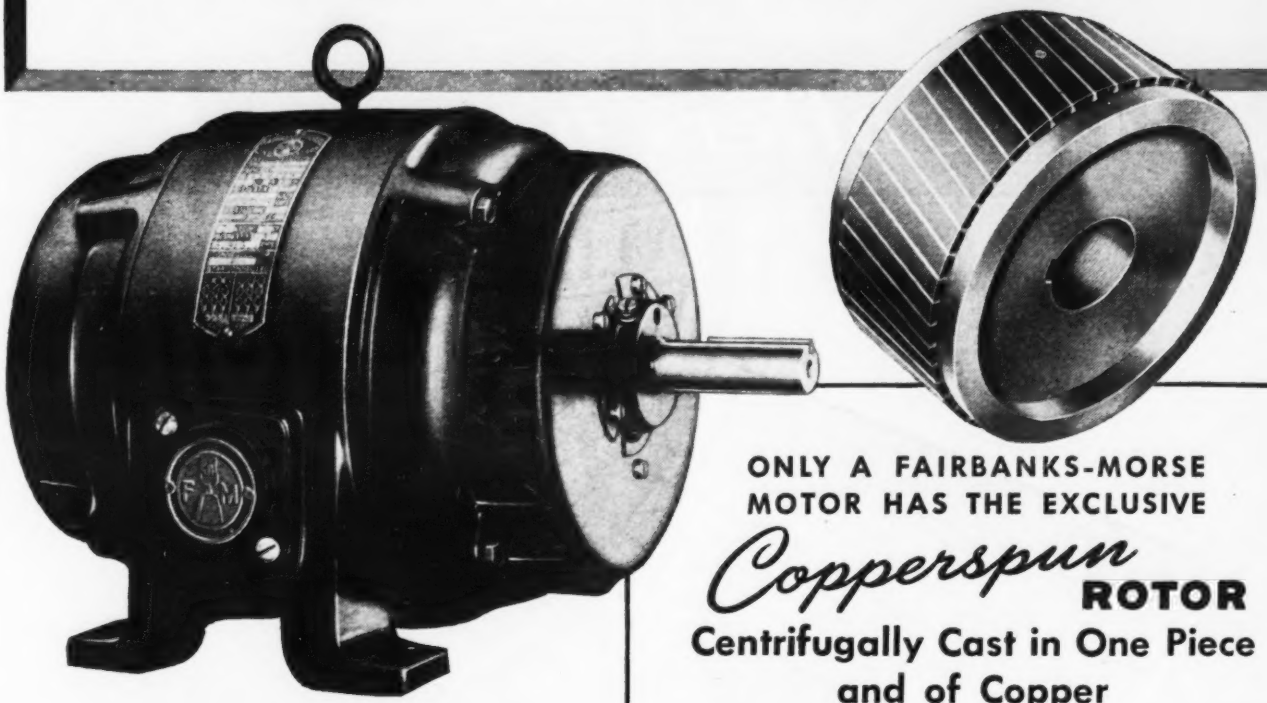


ALUMINUM in flat shapes, rounds, channels and angles, with fittings to suit; aluminum frames and sheet to house them; Alcoa can supply your electrical bus needs.

The book, "Alcoa Aluminum Bus Conductors", contains a lot of useful, general data. We'll gladly send you a copy. Alcoa engineers will answer your specific questions. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN ALUMINUM

A BETTER ROTOR
A BETTER MOTOR



ONLY A FAIRBANKS-MORSE MOTOR HAS THE EXCLUSIVE

Copperspun **ROTOR**

Centrifugally Cast in One Piece and of Copper

It took *years* to develop the Fairbanks-Morse centrifugally-cast, one-piece copper rotor. But it's worth it. Reduced operating costs and longer, more dependable service are the results.

But those aren't the only advantages you get in a Fairbanks-Morse Motor. There's a long list of other features that all add up to *better* service for you. Note the list below. That's why we call it tomorrow's motor today.

Check List of Plus Features

Protected Frame— Dripping liquids and falling particles excluded in any mounting position.

Symmetrical Design— Reversible frame provides for locating conduit box on either side. Bearing arms can be mounted in any one of four positions 90° apart.

Crossflow Ventilation— Another exclusive feature in frames 224 to 365 inclusive. Air moves in both directions, providing a motor of uniform temperature. No hot spots.

Recessed Conduit Box— An innovation for neat installations. Choice of conventional box or frame recess with cover flush with frame.

Balanced Characteristics— Motor rated 40°C with high efficiency and power factor and excellent starting and accelerating torques.

Ball Bearings— Sealed in and protected.

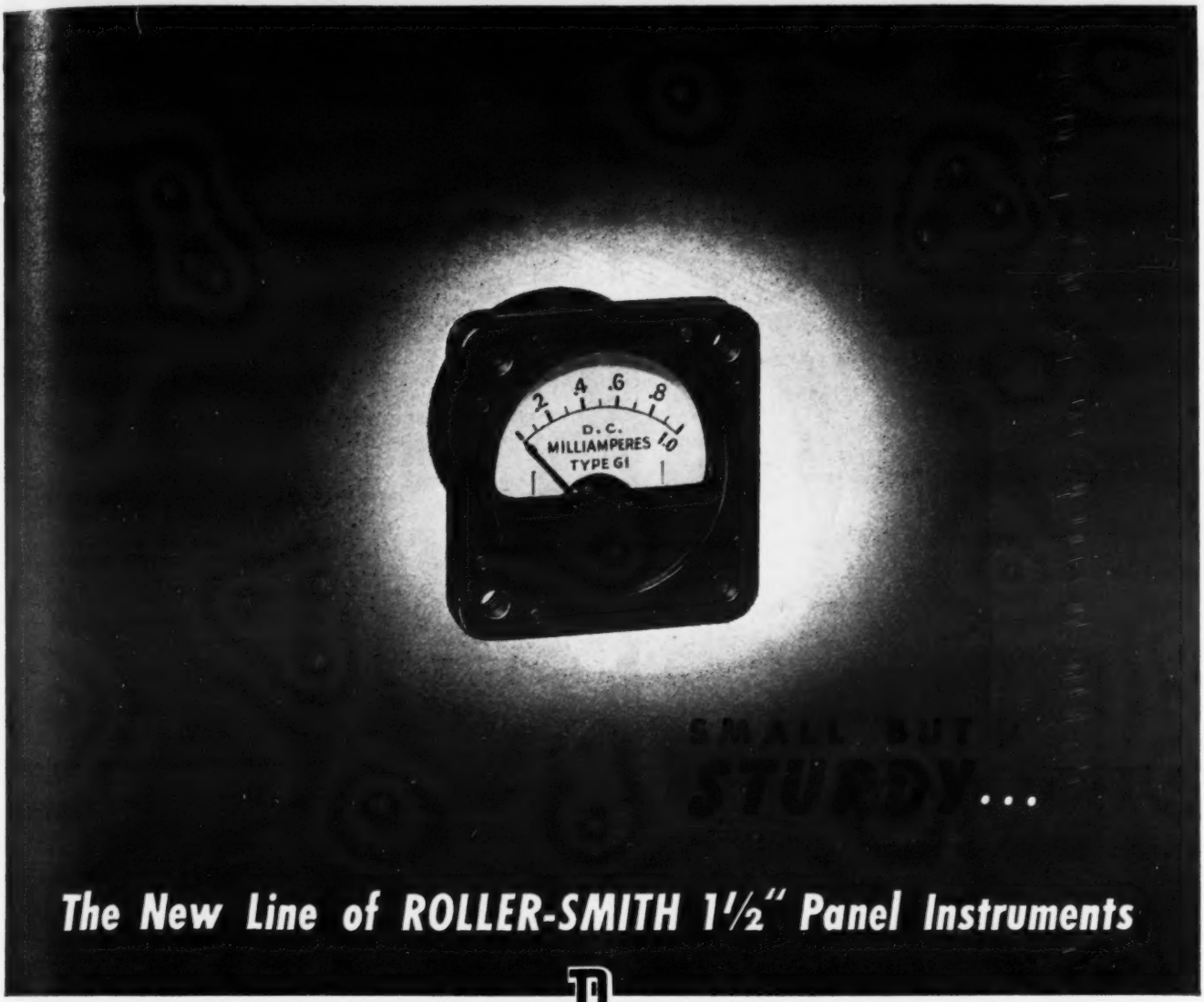
Write for information, Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

BUY MORE WAR BONDS

Fairbanks-Morse

A name worth remembering

Diesel Locomotives · Diesel Engines · Generators · Motors · Pumps · Scales
Magnetos · Stokers · Railroad Motor Cars and Standpipes · Farm Equipment



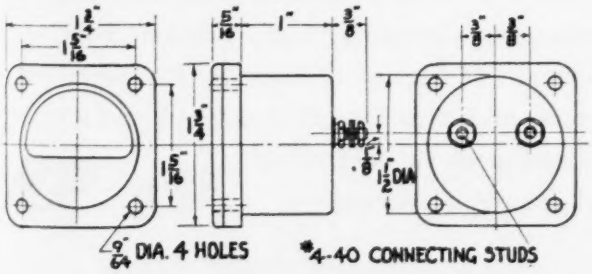
SMALL BUT STURDY...

The New Line of ROLLER-SMITH 1½" Panel Instruments

Design and development of this line of 1½" instruments were based on rigid U. S. Army Air Force specifications. They are built to withstand extreme conditions of temperature, humidity, vibration and shock, and immersion tests have demonstrated their ability to withstand a hydrostatic pressure of 14.7 psi.

Roller-Smith 1½" instruments are now available in d-c voltmeters, 1000 ohms per volt, in all practical ranges above 50 millivolts; d-c ammeters in all practical ranges above 500 microamperes. For certain applications instruments can be supplied with ranges below those specified. Correspondence is invited.

When desired, solder lugs can be furnished instead of the connecting studs shown.



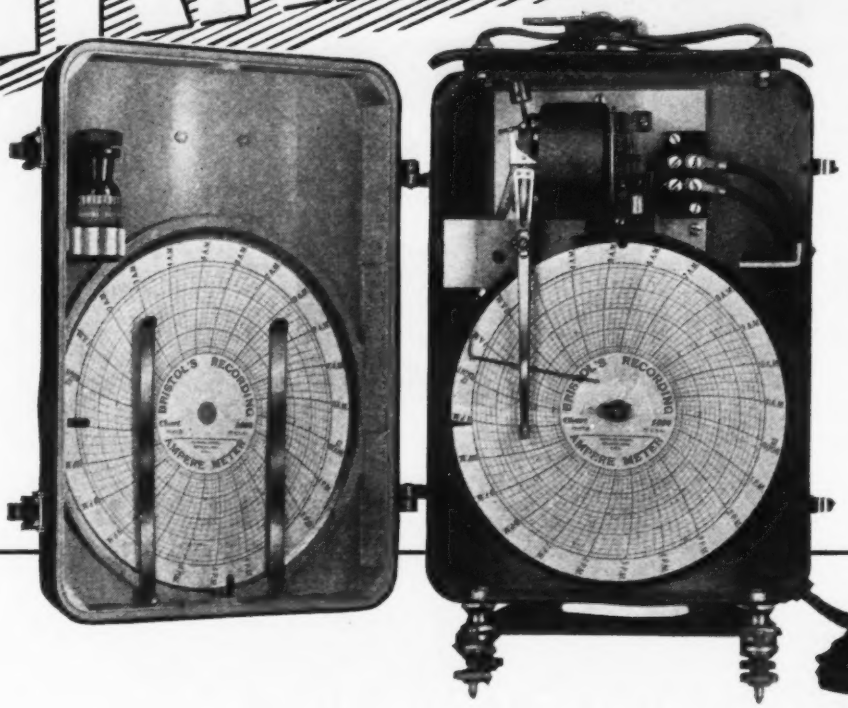
ROLLER SMITH

Sales Representatives In all Principal Cities

ROLLER-SMITH BETHLEHEM, PENNA.

STANDARD AND PRECISION ELECTRICAL INSTRUMENTS • AIRCRAFT INSTRUMENTS • SWITCHGEAR • AIR AND OIL CIRCUIT BREAKERS • ROTARY SWITCHES • RELAYS • PRECISION BALANCES

WARNING



Bristol's Portable Recording Ammeter

Locks securely during travel. Gasketed door. Magnetic damper. Measuring element easily replaceable. One, two or three-pen styles.

YOU'LL STAY A STEP AHEAD OF TROUBLE WHEN YOU USE THIS INSTRUMENT TO RECORD CURRENT FLUCTUATIONS

Bristol's Portable Recording Ammeter will go trouble-shooting with you wherever you go.

Hang it on a pole . . . mount it on a wall . . . take it down a manhole . . . set it on a damp cellar floor . . . it responds instantly and accurately to the slightest fluctuation in current.

Lightweight (17 lbs.), compact, sturdy, Bristol's Portable Ammeter combines convenience with accuracy to give you a constantly reliable picture of what's going on.

Write for complete facts in Bulletin E1100. Address THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 91, Conn. (The Bristol Company of Canada, Ltd., Toronto, Ontario. Bristol's Instrument Company, Ltd., London, N.W. 10, England). Makers of Metameter, Recording Ammeters and Voltmeters, Thermoverter and a broad line of automatic controlling and recording instruments.

Gives You the Facts when and where you want them

AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS

Chromel helped you plan Tomorrow's Home

38 YEARS AGO

For your home of tomorrow, you likely are planning to use electric heat wherever it is practical. You and your customers have learned to like electric heat, because you have learned it is dependable. This is so, because of the discovery of Chromel heating units, back in 1906. Chromel elements last a long, long time. They last so long, that when they at last wear out, it merely reminds you of how extremely durable Chromel is. . . . For full technical data on Chromel, ask for our Catalog-M.

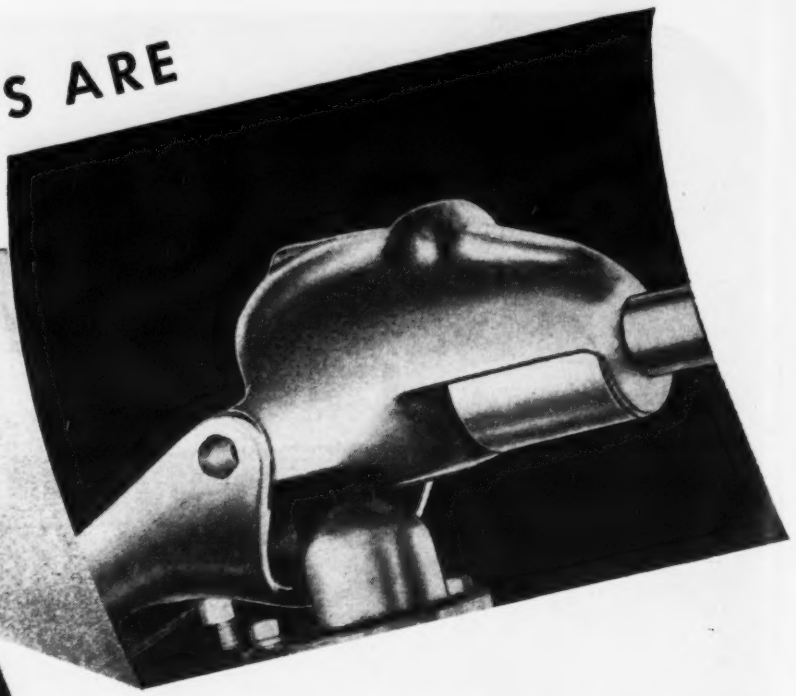
RESISTIVITY @ 68° F

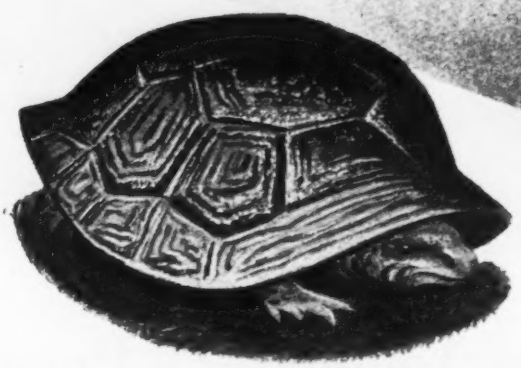
	WIRE (C. M. Ft.)	RIBBON (Sq. M. Ft.)
Chromel-A	650 Ohms	510 Ohms
Chromel-C	675 Ohms	530 Ohms
Chromel-D	600 Ohms	471 Ohms
Copel	294 Ohms	231 Ohms

Chromel NICKEL CHROMIUM
HOSKINS CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

HOSKINS MANUFACTURING COMPANY, DETROIT 8, MICHIGAN

OPERATING PARTS ARE COMPLETELY ENCLOSED





... Opens and closes under all service conditions, new Westinghouse Type V Disconnecting Switch is fully protected against elements and corrosion.

Type V Outdoor Disconnecting Switch rated 600 amperes, 69 kv.

Here is a new idea in a disconnecting switch . . . a complete enclosure of vital moving parts. Heavy ice and corrosive formations will not "freeze" switch in open or closed positions.

There are *only three moving* parts, for reliable and simple operation, capable of opening and closing the switch easily under any weather conditions.

Regardless of the length of time between switch operations, the Type V Disconnecting Switch can be opened and closed smoothly and with minimum effort. Contact pressure is released *completely* before the upward movement of the arm begins, breaking any ice or corrosive seal that might have formed. On ratings 46 kv and above, a strong counterbalancing spring aids lifting of arm.

Maintenance is reduced to periodic inspections. Contacts are self-cleaning. No adjustment is necessary after installation. There are no shunts to corrode and break.

Ratings are from 7½ to 230 kv, 400 to 2000 amperes. For complete information write for Booklet B-3480. Westinghouse Electric & Manufacturing Company, P.O. Box 868, Pittsburgh, Pa. J-60571

Westinghouse

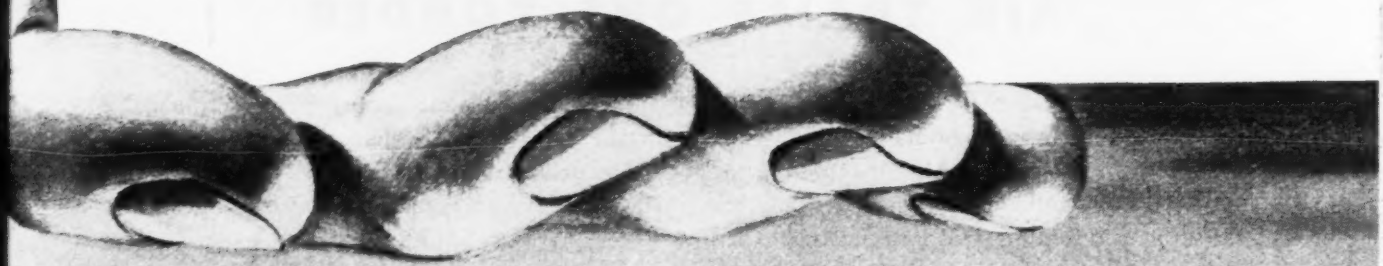
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

TYPE V OUTDOOR DISCONNECTING SWITCH

Another Great Leader in a Great Line... FWD's Model SU

Famous 5-Tonner Tops

$75,000,000.00 ENDORSEMENT



When a single model of a heavy duty truck is purchased in volume reaching a total dollar value of $75,000,000.00 in less than four years time, it rightfully gains leadership in its field. FWD's Model SU has won an extraordinary recognition—the endorsement of motor truck buyers exemplified in $75,000,000.00 worth of trucks bought and used since 1940.

It is significant, too, that in a comparatively brief period of years this single model FWD has a background of $75,000,000.00 in manufacturing experience as well. In every sense it is a great leader in a great line of trucks.

The FWD model SU represents the most advanced development of the four-wheel-drive principle originally pioneered and sponsored by FWD since 1910. It is eminently qualified in every element of design and construction to render service of a character and extent far beyond that of any other truck.

More than ever before essential industries and motor transport organizations rely on Four-Wheel-Drive hauling power to do more work — cover more miles — at lower cost for gas — oil — tires — replacements.

When your need is dependable all-season, all-weather hauling power — look to FWD's — a great line of trucks.

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin
Canadian Factory: KITCHENER, ONT.

FWD TRUCKS

EST AND ORIGINAL EXCLUSIVE BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS

★ NUMBER 14 IN A SERIES OF MESSAGES BY KELLETT AIRCRAFT CORPORATION ★

AIR TRAILS OUT YONDER

Remote regions, otherwise inaccessible, may be brought in touch with the outside world by the helicopter of tomorrow. Able to land in any small clearing, and take off again, vertically, the helicopter will serve in transporting supplies and people safely, swiftly.

In many similar ways will post-war helicopters serve a progressive world, broadening and extending the facilities of commercial air transportation, adding new uses, new applications, to flying services.

New helicopter types, developed under Government wartime sponsorship, are already logging many valuable hours in experimental flight. Experienced Kellett engineers are confident that practical helicopters, with performance to serve an eager, air-minded public, will travel tomorrow's skies.

SEND FOR INTERESTING BOOKLET

Like many others, you may want more information about "flying without wings." "Answering Some Helicopter Questions" gives you many interesting, up-to-date facts. Write for your free copy to Kellett Aircraft Corporation, Dept. E, Upper Darby (Philadelphia), Pa.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

You Can Make Better Dead Ends With

Nicopress

Offset Dead End Sleeves

1. They are designed for use on copper, Copperweld and Copperweld-copper conductors.
2. They can be installed on Pin, Strain or Spool insulators.
3. Simplicity and speed of installation.
4. Strength and tightness.
5. Provide for a tail of any desired length.
6. No extra tools are required to make the offset dead end as the same tool used in making regular line splices will do the job. These convenient Nicopress Tools are small and compact and are extremely easy to operate close to the insulators or cross arms.

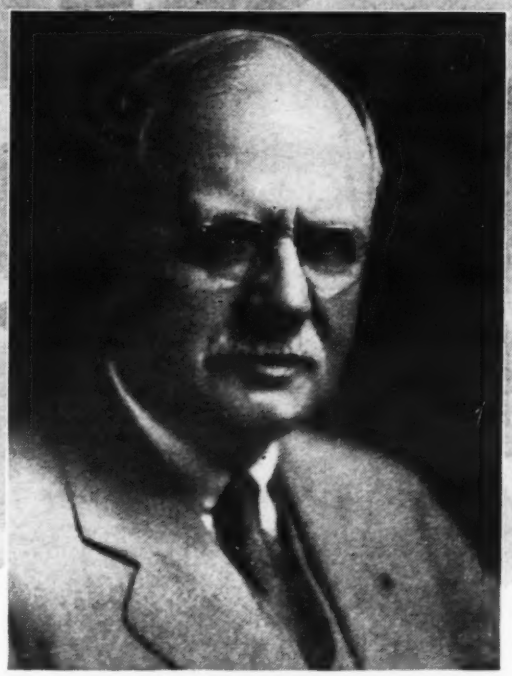
The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr. — N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor — INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

"Our Business, Like Yours, ...is *Different!*"



A few comments based on the first 50 years of the JAMES G. BIDDLE COMPANY

BUSINESSES, like people, usually have distinct, individual personalities. The smaller the business, the more clearly it will reflect the character of the man who built it.

In 1895, when the electrical industry was in its infancy, James G. Biddle went into business as a manufacturer's agent, selling electrical measuring instruments and scientific apparatus. One of his basic aims in the conduct of the business was to be more than a mere source of supply. He decided to provide a service that was outstanding by reason of its alert, interested, personal character. This aim has never been changed by Mr. Biddle or his associates during the last half century. It will continue to be an important factor in the policies of the James G. Biddle Company in the years to come. We are committed to this.

•

In celebration of our 50th anniversary, we have prepared a brief booklet entitled "Report at Mid-Century." It touches upon interesting points regarding the growth and advancements of the electrical field in general and our business in particular. We would be pleased to send you a copy upon request.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET • PHILADELPHIA 7, PENNA.

"MEGGER"* INSULATION TESTERS, GROUND TESTERS AND OHMMETERS • "FRAHM" TACHOMETERS AND FREQUENCY METERS • "JAGABI" RHEOSTATS • INDICATING HAND TACHOMETERS • SCIENTIFIC APPARATUS

*TRADE MARK REG. U. S. PAT. OFF.

Vinylite

TRADE MARK

Outspinning the spider

The spider is an engineer—a master of construction and design. While man piled massive stone on stone for the pyramids, the spider built with an extruded material of airy lightness and amazing strength—presaged the whole trend of modern practice.

Today, VINYLITE extruded elastic plastics bring this same invaluable combination to wire and cable insulation. With excellent dielectric properties, they permit new thin-wall construction, with notable reductions in the weight and thickness of insulation on electrical conductors. More circuits can be inserted in existing conduits. And to insulation properties unsurpassed by older types, thin-wall insulation of VINYLITE elastic plastics adds unusual resistance to chemicals, oils, grease, and abrasion. It stays flexible at low temperatures — has a very low rate of moisture absorption. Certain types are non-flammable or slow-burning. It can be made transparent or opaque, in an infinite variety of colors.

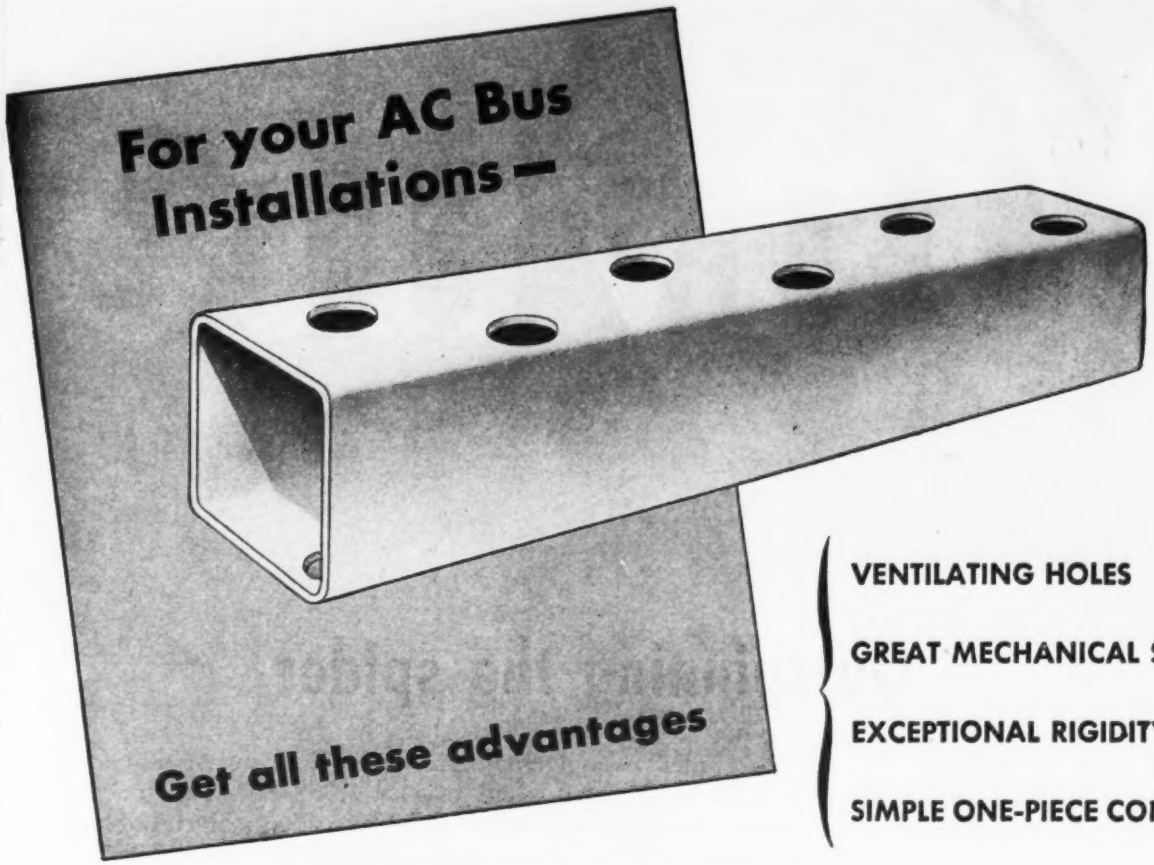
Insulation made from VINYLITE elastic plastics sets up new standards of life and service for the full range of conductors, from portable cords to power cables. Write Department **28** for booklet VR. It describes all the VINYLITE plastics for wire and cable insulation, and explains the specific advantages of each for different types of application.

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation

UCC

30 EAST 42ND STREET, NEW YORK 17, N. Y.

Plastics



VENTILATING HOLES

GREAT MECHANICAL STRENGTH

EXCEPTIONAL RIGIDITY

SIMPLE ONE-PIECE CONSTRUCTION

with CHASE VENTILATED BUS CONDUCTOR

Maximum mechanical strength in all directions (per pound of copper) . . . exceptional rigidity (no need for auxiliary clamping devices) . . . ventilating holes (in both top and bottom faces) for cooling by natural convection...simple one-piece construction. You get all four service features in Chase Ventilated Square Tube. Important in normal times, they're more than welcome now, for each feature helps conserve critical copper, too.

Before you decide on any new AC bus installations, consider these advantages of Square Tube. Complete information on Ventilated Square Tube, as well as other bus conductor forms, will be found in the Chase Electrical Handbook.

CHASE

Bus Conductor Calculations Got You Snowed Under?

Chase may be able to save you many hours of work on electrical problems. Why not consult Chase engineers on the most economical size and shape of bus conductors for your conditions? To take advantage of this time-saving service, just outline your conductor requirements.

CHASE BRASS & COPPER CO.

— Incorporated —

Waterbury 91, Connecticut

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

ALBANY †
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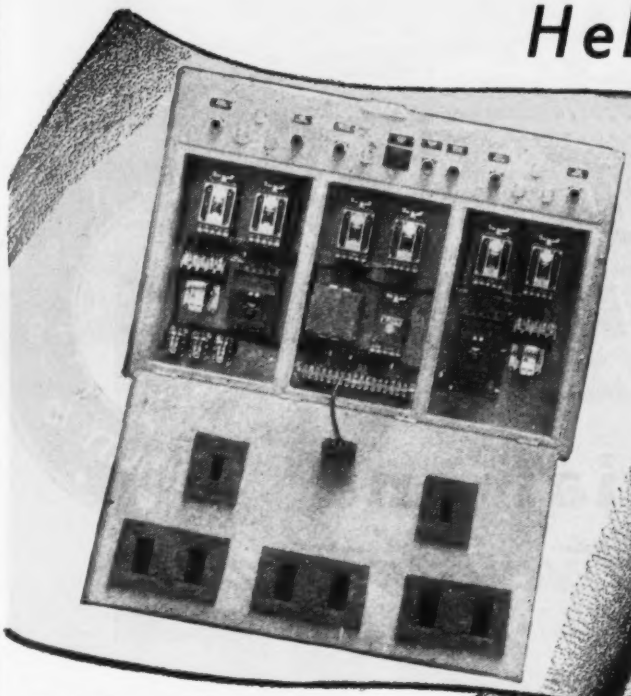
† *Indicates Sales Office Only*

This is the Chase Network—handiest way to buy brass

How Can a HEINEMANN MAGNETIC CIRCUIT BREAKER Help to Melt Glass?

Ask atc They Know!



Open View of ATC Automatic Tone Control Panel Showing HEINEMANN Circuit Breakers in Place.

Close up of the HEINEMANN Magnetic Circuit Breaker

"FULLY MAGNETIC" describes the most important feature of the HEINEMANN Circuit Breaker. This means that these breakers have a fully electro-magnetic trip unit that acts instantaneously on short circuits or dangerous overloads. They also have a true inverse time delay in a hermetically sealed unit which allows passage of inrush current. Continued overload, however, opens the breaker in time inverse to the ratio of the current. Breakers are manufactured with time delays closely matched to customer's specification. Magnetic Blowout Contacts mounted in individual arcing chambers add speed to the arc interruption.

When Automatic Temperature Control Co., Inc. wanted dependable equipment to be used as component parts in conjunction with the A T C complete line of automatic time controls, they turned to HEINEMANN for the protective device. And when the Hartford-Empire Co. developed its revolutionary new method of glass melting, the HEINEMANN Magnetic Circuit Breakers on the time control panels supplied by A T C bore the responsibility of protecting many thousands of dollars worth of vital equipment. It may be that HEINEMANN Magnetic Circuit Breakers can perform an equally important service for you.

Send for Catalog Showing Complete Line and Engineering Data

HEINEMANN CIRCUIT BREAKER CO.

Subsidiary of Heinemann Electric Co., Established 1888

103 PLUM STREET, TRENTON, N. J.

Continental-Diamond
Engineered Dielectric Materials

DILECTO parts, like those illustrated, are used throughout communications systems, detecting devices and controls wherever electrical currents must be insulated. DILECTO electrical insulating parts must function satisfactorily regardless of humidity, dryness, vibration, concussion. They must be mechanically strong . . . resistant to moisture and temperature . . . and dielectrically effective. In all these requirements DILECTO excels.

DILECTO is also readily fabricated. It may be machined, punched, drilled, tapped, and even formed. It is made in many grades . . . each engineered to meet specific electrical or mechanical problems. DILECTO may be the answer to your "WHAT MATERIAL?" problem. Send for catalog "DO" which gives complete technical and physical data.

KB-44

C-D PRODUCTS

The Plastics

DILECTO—A Laminated Phenolic.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

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IN CANADA:
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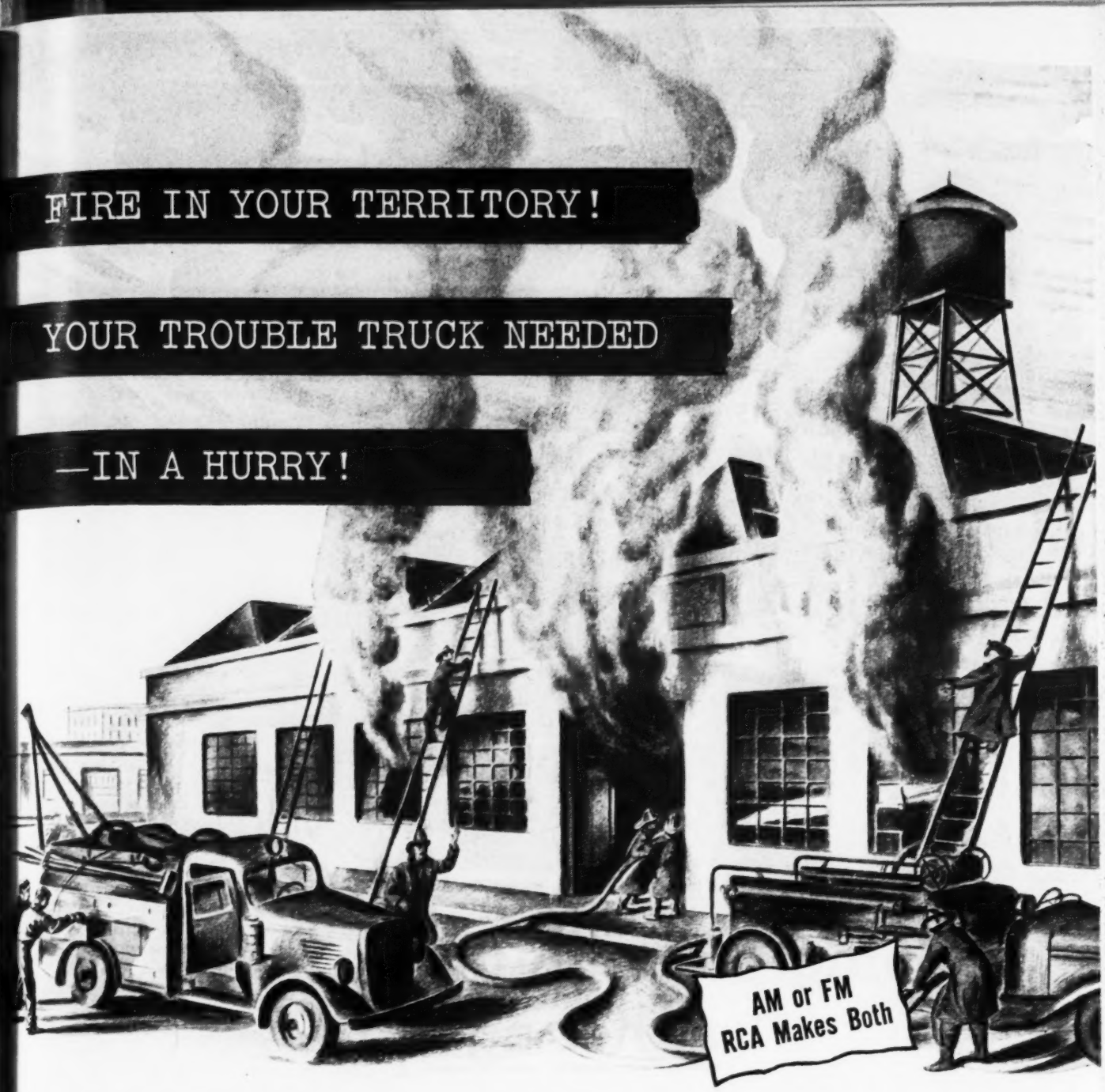
Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE



If you had an RCA 2-Way Radio System you could contact the nearest of your trucks instantly—get it there faster!

That is only one example of many ways in which such a system could serve the public usefully by helping your company.

More and more electric light and power men realize that a 2-way radio system of this character for emergency communication is urgently needed, from every standpoint.

More and more companies are making definite plans to install such a system just as soon as war priorities will permit. RCA engineers will gladly help you work out the details of a system best designed to meet your requirements.

BUY MORE WAR BONDS

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

In Canada, RCA VICTOR COMPANY LIMITED, Montreal

G-E ADVERTISEMENTS LIKE THIS
Appearing in leading general business and industrial publications, are designed to stimulate interest in postwar installations of Air Conditioning and Refrigeration—a promising market for the sale of G-E equipment . . . and electric power.

Going out with the Army... at her age?

IT used to be months before a casting outgrew its brittleness and was *mature* enough to go anywhere. Naturally, that was costly, keeping "green" castings around for necessary seasoning out-of-doors.

Now, castings are seasoned to meet even the unusual requirements of war production in a few hours' time—by *industrial refrigeration.*

This is just one of many interesting ways in which Refrigeration and Air Conditioning are serving American industry-at-war.

General Electric engineers, in order to meet war-time conditions, have vastly improved industrial refrigeration and air conditioning equipment. Today, it is more compact, more flexible, more efficient.

When the war is over, these improvements will be reflected in a host of better things for peacetime living . . . better, and costing less, thanks to General Electric.

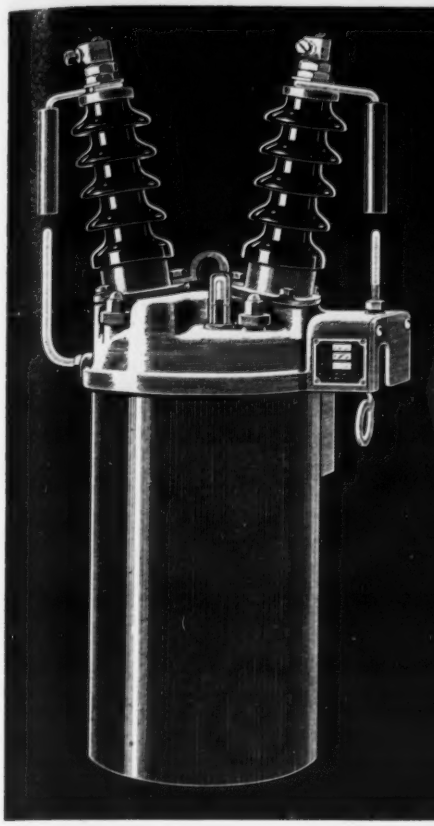
☆ BUY... and hold... WAR BONDS ☆

General Electric Co., Air Conditioning and Commercial Refrigeration Division, Section 5192, Bloomfield, N. J.

Air Conditioning by

GENERAL ELECTRIC

Hear the General Electric Radio Programs: The "G-E ALL-GIRL ORCHESTRA," Sundays, 10 p.m., E.W.T., NBC... "THE WORLD TODAY" News, Every Weekday, 6:45 p.m., E.W.T., CBS



Because of their dual operating characteristics

TYPE "H" KYLE AUTOMATIC Oil Circuit Reclosers will increase your revenue

Kyle Automatic Oil Circuit Reclosers at strategic points on your lines can be counted on to isolate permanent faults to the shortest possible branches . . . keep the revenue producing current going to the main lines and all unaffected branches.

These dual operating characteristics, as exemplified in the Type "H" Kyle Automatic Oil Circuit Recloser, provide:

1. *Fast Opening* of the Recloser on the *First* and *Second* Operations.
2. *Time Delay Opening* of the Recloser on the *Third* and *Fourth* Operations.

Only a Kyle Automatic Oil Circuit Recloser with these dual operating characteristics will clear all temporary faults and also permit the use of additional sectionalizing devices to isolate permanent line faults.

Advantages of Dual Operating Characteristics

1. All temporary line faults, which comprise 90% of line disturbances are cleared AUTOMATICALLY.
2. Service continuity is increased with resultant higher revenue and better customer satisfaction.
3. Outages are confined to the smallest possible area.

Ask your Line Material Representative to furnish you with complete details on the Type "H" Kyle Automatic Circuit Recloser and how it can be used most effectively to protect your system.

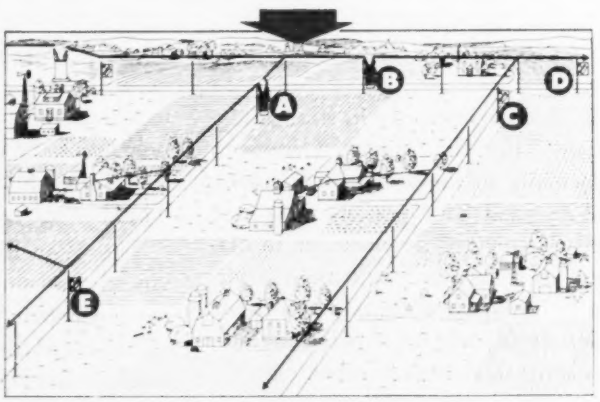
RECLOSER RATINGS: Volts—2400 to 15,000; Amperes—5 to 50; Tripping Current—10 to 100 Amperes; Interrupting Current—150 to 1200 Amperes.

HERE'S HOW IT WORKS:

To protect branch lines from a substation feeder, Kyle Reclosers are located at "A" and "B" to isolate the branches from the main line. Fuses are used on the load side of the Kyle Recloser at "C", "D", and "E" to sectionalize the branch line.

If a fault beyond the sectionalizing fuses is not cleared on the first two operations of the Recloser, it is considered of a permanent nature and the branch line should be isolated by the blowing of the sectionalizing fuse. The Type "H" Kyle Automatic Circuit Recloser permits coordination with the sectionalizing fuse on its third and fourth operations, so that the fuse is blown before the Recloser locks out.

In this way, the line outage is confined to a small portion of the protected system and service is maintained to the remainder of the system.



MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

KYLE Circuit Breakers are Designed and Manufactured for LINE MATERIAL COMPANY MILWAUKEE WISCONSIN

A MICA MINE
IN A LABORATORY

War shortages crop up in strange materials. Mica, for instance. Once seen principally in the windows of stoves, and in small boys' pockets, it is now used extensively as electrical insulation. In some war products, it is virtually indispensable: capacitors for radio, spark-plugs for airplane engines, insulators in electronic tubes.

With demand mounting, manufacturers were desperate. A four-man technical mission flew to London to help ration the world's supply between the United States and Great Britain. The shortage was serious.

The War Production Board, convinced that much mica was classified too low when judged by appearance alone, asked Bell Telephone Laboratories to develop a new method of electrical tests. The Laboratories were able to do this quickly and successfully because of their basic knowledge and experience in this field.

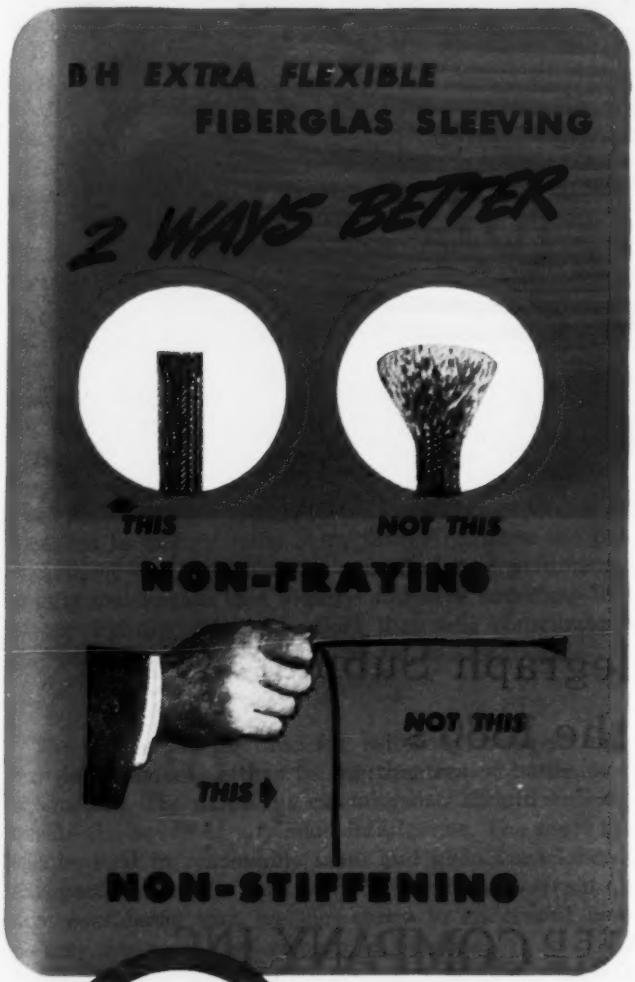
The new tests were made available to manufacturers in this country and abroad—the supply of usable mica was increased 60% — and a difficult situation relieved.

Skill to do this and other war jobs is at hand in Bell Laboratories because, year after year, the Laboratories have been at work for the Bell System.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for our Armed Forces at war and for continued improvements and economies in telephone service.

BH NON-FRAYING FIBERGLAS SLEEVING



INSERTING bare wire in rough sleeving that frays out on the ends is time- and patience-consuming. The job is much simpler and less irksome when you use BH *Extra Flexible* Fiberglas Sleeving, the non-fraying, smooth bore insulation that takes fine-stranded wires without a hitch.

Special-processed BH Sleeving is *permanently* flexible and non-fraying. It won't harden and crack with age, and it won't burn. In addition, it has all the other desirable electrical and physical features of inorganic Fiberglas.

If you're looking for an easy-working, long-lasting insulation, why not try BH *Extra Flexible* Fiberglas Sleeving? It's available in all standard colors and sizes from No. 20 to 5/8", inclusive. Write for samples today!

BH SPECIAL TREATED FIBERGLAS SLEEVING CUTS CLEAN, DEFIES HEAT

Here's another high quality BH Fiberglas Sleeving. No saturant is used in the exclusive BH process, yet the sleeving will not fray when cut and withstands heat up to 1200° F. Made in natural color only—all standard sizes. Try it!

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SLOW-BURNING IMPREGNATED MAGNETO TUBING • SLOW-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

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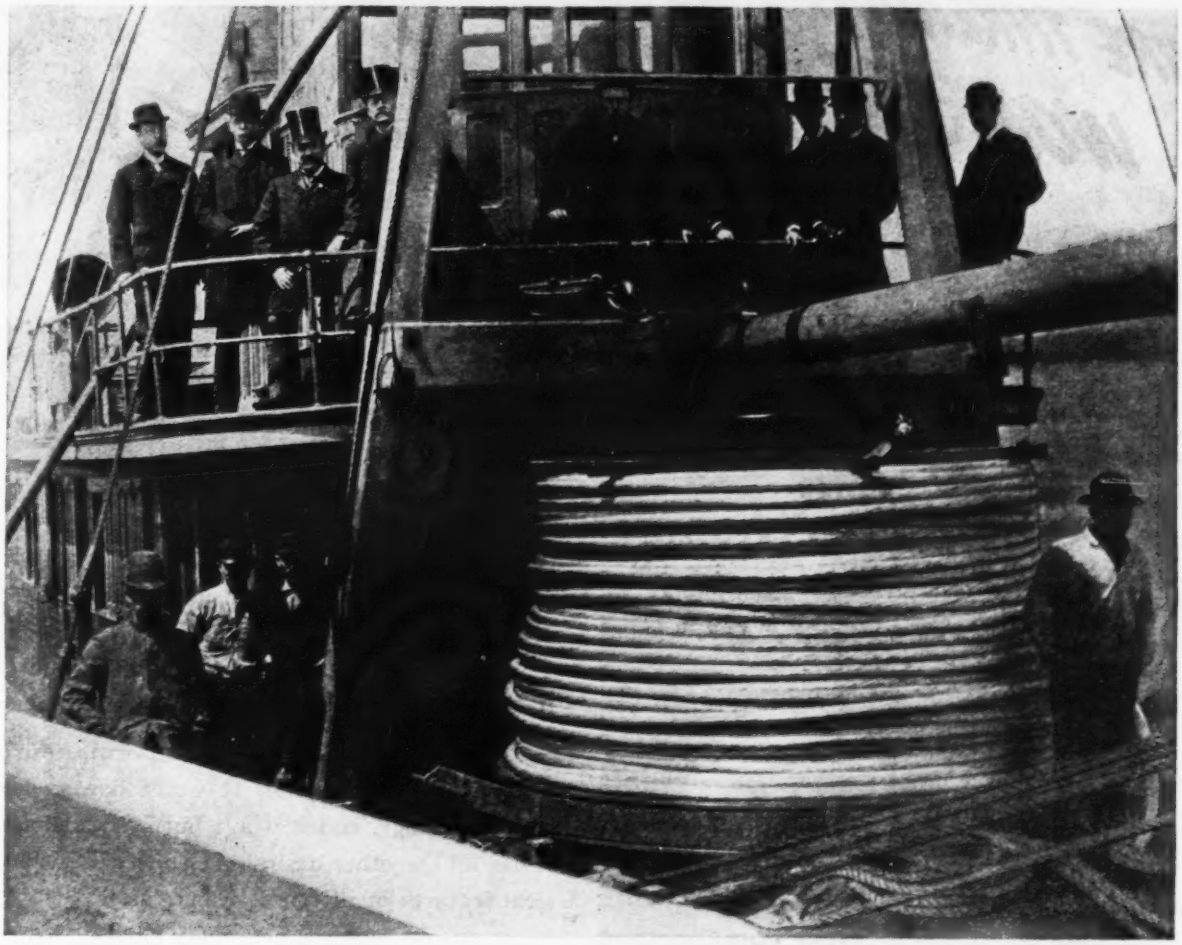

Installing Kerite Telegraph Submarine Cables in the 1880's

THE KERITE INSULATED WIRE & CABLE COMPANY INC
NEW YORK CHICAGO SAN FRANCISCO

Pioneers in Cable Engineering

REDEDICATION

An Obligation to Our Fighting Men

DURING the last few weeks we have been forcibly reminded that so long as we still are fighting either of our major foes, first claim upon the productive resources of the United States—its manpower, materials, utilities, and industrial facilities—must be the production and delivery of munitions and war supplies. All other claims are secondary. No responsible citizen would have it otherwise. For in this war even more is at stake than our existence as a Nation. We dare not forget that we are engaged in a struggle that challenges the fundamental values upon which our civilization has been built.

It is not easy to list the values that we are fighting to uphold. They have been clothed in a variety of shapes over the centuries. They will assume new forms in the years ahead. But they have an inner consistency that free men the world over can feel and recognize: the right of the commoner against the noble, the right of the individual against the state, the right of trial by jury, the right to vote, the right to an education, the right to freedom of speech and worship, the right to work in a sphere of one's own choosing, the dignity and the equality of the individual under the law—these are our cultural heritage, painfully won and often precariously held over the ages, always to be rewon, redefined and buttressed by each succeeding generation of men.

The preservation of this vital core of value, and its transmission to our sons and daughters depends upon our victory in this struggle. So those things which are essential to victory must come first. And since the production of war munitions in overwhelming volume and quality can hasten that victory and save countless lives of our fighting men, no effort that will contribute to this end should be regarded by us as a sacrifice.

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The present is no time for self-congratulation upon our achievements either in the theatres of battle or of production. The mounting casualty lists should suffice to curdle the savor of any such indulgence. The most that can be said in reasonable taste and good conscience is that performance in both fields is such as to warrant our firm confidence that we can carry to successful completion the tasks that remain to be done.

Nor is there profit in even observing, much less deploring, that the tasks ahead are more formidable than those which were defined for us a few short months ago. Then, all of us—military leaders, government officials, workers, and business men—were riding a crest of optimism as to an early end of the war in Europe and as to the character and dimension of the war against Japan. Already we had begun to turn anxiously toward the problems of reconversion which then seemed so near at hand. Schedules for war production, based upon the best available estimates of need, called for a 5 billion dollar reduction from 1944 performance, even though we might have to continue a two-theatre war, and for a 40 percent reduction in the event of an early victory in Europe.

Today, those forward estimates have been revised sharply upward. That is true both of the 1945 requirements to meet the needs of a two-theatre war, and of requirements for the Pacific war once the European phase is ended. For this upward revision four chief reasons are responsible:

1. European battle experience has shown markedly greater use of expendable munitions than was provided in the formulae upon which our original production schedules were calculated: the result has been a depletion of inventories on a scale that would become dangerous if allowed to continue.
2. Experience has also demonstrated the need for new types of weapons or increased complements of some existing types to match new enemy equipment or tactics.
3. A less easy optimism as to the early ending of the European war has given rise to a growing disinclination to gamble on the approximate date.
4. An increasing conviction prevails that the war against Japan may require ground-army operations on the Asiatic mainland on a scale greater than originally premised.

But if these changes in the fortunes and outlook of war have raised our estimates of military requirements, may not subsequent favorable changes in the military situation cause them again to be revised downward? It is entirely possible. But our military men have learned that they cannot safely discount what *might desirably happen* as something that *will happen*. Those working on the production front also must learn that lesson. Fortunately, the record shows that we have been able to maintain a war production almost equal to that of the rest of the world combined, even while we produced for civilian use on a scale that has been large even by our

own pre-war standards. So we have ample margin to whip whatever war job may be required of us. As now defined, the task will not be easy. But it *can* and *will* be done.

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What, then, is the production task with which we are charged? Our 1945 production for the two-theatre war now calls for the substantial maintenance of the over-all levels reached in the latter months of 1944. But there is a shift of emphasis. Almost half of the programs for specific equipment items are declining. A few are scheduled to hold level. About 45 percent are scheduled to rise sharply. That means that workers and facilities must be shifted to man the expanding programs. At the same time the armed services are calling for many more men than can be supplied from those who become newly eligible to the 18 year old age group. That means further drafts upon war workers. It means also replacements for them when they are taken from the expanding programs. Finally, events demand that we produce as much as possible of many items during the first half of 1945.

Our task, then, is one of intensified effort for the immediate future, with multiple readjustments at a stage when adjustments are hard to make. Materials for which demand was easing as pipe-lines were being drained in anticipation of falling schedules again are tight as the pipe-lines are being refilled to meet augmented requirements. Men, women, and facilities must be shifted from less essential to more essential tasks. What must be done will be done. But unless there is much voluntary accommodation, it will be necessary for us to suffer a formidable amount of governmental direction which none of us likes, many of us deeply resent, and all of us, when personally affected, volubly protest. The more we police ourselves, the less we shall be policed.

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Even after Germany has been defeated, we shall still face a far from light production requirement to continue the war against Japan. As currently defined this phase might require war expenditures at something like $70 billions a year, an over-all reduction of approximately 20 percent from the $89 billions spent in 1944. Reduction in munitions output would be somewhat greater, probably from 25 percent to 30 percent below 1944 levels. But it is important for us to acknowledge that the reduction is going to be substantially less than the 40 percent previously estimated.

Only a few months ago there were those who questioned sharply the possibility that we might need 60 percent of current munitions output to win the Japanese war. Now the judgment of the military is that 70 percent will be none too high.

Actually the latter level would represent an increase of little more than 50 percent above what now is being produced for the Pacific area. This, certainly, is a modest estimate when we reflect that we shall inevitably more than triple the Army forces assigned to that theatre.

Such a program probably would give us a current munitions supply from three to four times that produced by Japan, but it is believed that we shall need that much to compensate for the advantages derived by Japan from the fact that she will be fighting a defensive war, from the volume of her accumulated stores, from her prepared positions, her shorter lines of supply and transport, and from her large troop reserves, the bulk of which we have yet to meet in battle. Certainly our present 3 to 1 production edge over Germany does not appear to be excessive.

The more modest V-E Day cuts contemplated by the present plan will mean a less acute reconversion problem when they are made, but will leave a greater one to be met at the end of the war. They will mean probably a net increase of not more than 4 million workers available for civilian work during the transition period. Their orderly absorption should present no embarrassing problem. Indeed, we now are warned by Washington that war production following V-E Day may require the protection of considerably closer control than was contemplated under the 40 percent cuts previously expected.

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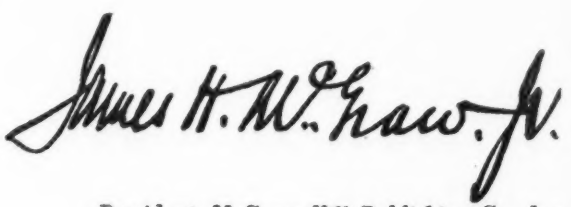
In short, we face for the immediate future a more difficult production job. It is made the more formidable by the fact that we had dulled the keen edge of our will to produce by our premature expectation of a reduction in requirements. Now we are told that the trend of war production for the immediate future is up, that it is unsafe to discount the date of victory in Europe, and that the amount of leeway for reconversion after the defeat of Germany is less than had been anticipated.

Accordingly, we must rededicate ourselves to the task of driving war production up. We must do without some of the things that we have enjoyed on the civilian front rather than demand more of those things; we have still to devote our abilities and energies first and foremost to the demands of war.

Whatever will assure and hasten victory must have first place in any statement of American policy.

Without victory, our aims, and the underlying values upon which they are based, will be extinguished, blotted out by the opposing aims and values proclaimed by our enemies.

The needs of our fighting men must be put first. For, unless we win the war, the National aims and policies of the United States will cease to have meaning in the world.



President, McGraw-Hill Publishing Co., Inc.

Electrical World
FEBRUARY 3, 1945

Engineering Meetings in Wartime

ANY QUANTITATIVE STATEMENT of direct contribution by it to the war effort is probably impossible, but no one who has the least comprehension of how important electrical developments are to successful prosecution of the war will question the value to the nation of the annual midwinter meeting of the American Institute of Electrical Engineers reported in this number of ELECTRICAL WORLD.

Since the meeting was held before February 1, the date from which the ban on conventions took effect, it is the case that the letter of the law was not infringed. But the Institute does not need to assert this purely technical defense to justify its decision to go through with plans made for the meeting. The matters presented and discussed amply prove the meeting's war-time value.

Directly concerned with problems of the war effort was a considerable number of papers and planned discussions on electrical applications in war goods production and design. Obviously, the information thus disclosed does not belong in the "hush-hush" class, but the fact that it is not secret does not mean it is widely known. To make it known to as many as possible of those who might still conceivably find good immediate use for it was a worth-while object, an object that was accomplished in its expected measure. And from such dissemination of knowledge among a wide-awake group of engineers, always looking for solutions of the problems that are their daily occupations, it is not at all unreasonable to assume that at least a few direct contributions to the war effort will result, although they may never be reported.

The condition of being "all out" in prosecution of the war does not mean that the nation must or can cease from every non-war interest and activity. The needful occasions of some 130 million people go right on, even though restricted and circumscribed, war or no war. And the part of electricity in these occasions is no less, actually it is more, than it ever was. Thus, while such things as the establishment of rating and design standards for turbo-generators, the promise of significant increase in interrupting capacity of circuit breakers and the remarkable implications of effects silicone resin insulations will have on the sizes and shapes of electrical apparatus would be of small meaning to the man in the street if he were told of them, yet they do greatly affect him and his way of life today and will do so even more greatly tomorrow.

In degree and kind the same values inhere in the meetings of the engineering committees of the Edison Electric Institute. These meetings, which will be held as scheduled, do not come under the proscription of the Office of War Mobilization because their attendances will be much below the limit of 50 that has been set. Nevertheless, we believe these meetings would cheerfully have been cancelled were it not that those men responsible for them justifiably hold that the matching of experiences in serving today's urgent loads is imperative now. If the knowledge and know-how exchanged proves helpful later, the gain is a double one.

We believe also that if the A.I.E.E. meeting had been set for a time after February 1 it would have been called off. What, if anything, would thus have been lost, no one can say. And no one can say, in terms of direct benefit to the war effort, what was gained by holding it as planned. But there was a gain.

Winter Meeting of A.I.E.E. Explores Pressing Problems

Electrical engineers foregather to discuss wide variety of war-era problems—Turbogenerator standardization advanced—Circuit breaker disclosed to meet rising interrupting demands—Cable sheath corrosion studied—Few new developments but many conference hours

INTENSIVE DISCUSSION of matters affecting the continuing war effort dominated the sessions of the American Institute of Electrical Engineers Winter Technical Meeting in New York, January 22 to 26, 1945. Various issues precipitated by the stepped-up military and industrial requirements are evidently still such pressing problems as to warrant collective analysis. Persistence of material shortages along with abruptly rising demands on the electrical systems has profoundly modified engineering design and operation and it continues to be imperative to match notes on the resulting experience.

This flavor permeated both the conception and execution of the programs for the numerous sessions. Thus out of them came a new set of standard ratings for turbogenerators, new specifications for the generators, circuit breakers that are keeping securely ahead of the interrupting requirements of heavily loaded interconnections, silicone insulations for higher temperatures, etc. Simplified war-time distribution systems and substations for both utilities and industrial plants were candidly but informally discussed for immediate as well as future guidance. Cable sheath corrosion was the theme of another session.

Circuit Breakers

Field Tests and Performance of Heavy-Duty High-Speed 138-kv. Circuit Breakers—Oil and Air-Blast. Philip Sporn and H. P. St. Clair (both Amer. Gas & Elec. Serv. Corp.).

Twenty 3-cycle interruptions up to 3,500 mva. with 13-cycle reclosure indicate that goal of 5,000 mva. with 12-cycle reclosure is definitely attainable.

A 3-cycle 3,500-Mva. Air-Blast Circuit Breaker for 138-Kv. Service. H. L. Byrd and Ben S. Beal III (both General Electric).

Further designed and tested for 14-cycle reclosure on 3,500 mva. with external blade; based on general success of air-blast at 34.5 and 69 kv.

A High-Capacity High-Voltage 3-Cycle Oil Circuit Breaker. H. L. Byrd and E. B. Rietz (both General Electric).

Interrupts 3,500 mva.; recloses in less than 20 cycles; reduced length of pressure-generating arc; new high-speed trip latch; pneumatic operation. One test interruption at 5,500 mva.

The Next Step in Interrupting Capacity 5,000,000 kva. A. W. Hill and W. M. Leeds (both Westinghouse).

Systems, designs, tests and performance all construed as presaging extension to 5,000 mva. with shorter than 20-cycle reclosure.

Circuit breakers of 5,000,000-kva. interrupting capacity will be ready when the need exists. That was the conclusion because field tests have demonstrated the maturity of the 3,500,000-kva. breaker to meet the duty imposed by system growth to carry the wartime loadings. Interruption of as much as 3,000,000 kva. in less than 3 cycles was among the "firsts" claimed in the presentations. Unanimity ruled on the assurance of the 5,000-mva. breaker, particularly in its air-break form, but there was considerable argument regarding the sufficiency of laboratory tests with magnitudes as steadily rising as they are.

Even though he and his associates concurred in the promise of the enlarged rating M. H. Hobbs (Westinghouse) pointed out that the larger the capacity the fewer the relative number of such ratings required and implied that would have a bearing on development-cost allocations necessitating close coordination of user and maker thinking. He estimated the airblast mechanism would make that type

more costly than the oil breaker. Low oil content has been a successful innovation, he said.

Seismograph recording of the motion of the 3-cycle oil-breaker in the A.G.&E. tests was not over $\frac{1}{8}$ in. and the 12-cycle reclosure was less jolting than the interruption, said W. F. Skeats (GE).

More than a dozen 138-kv. airblast breakers have been designed since 1934 and operated successfully by the Montreal system, said H. W. Haberl, and the air supply has been no insuperable problem. One has interrupted the 3-phase equivalent of 7,000 mva. in 3 cycles and a new 60-kv. unit will shortly be in service for 2-cycle opening and 10-cycle reclosure. Airblast breakers, in Haberl's opinion, are past the experimental stage even for severe climates.

Over a 5-year period the Indianapolis system has been relocating, rebuilding and replacing breakers to keep ahead of the growing fault potentialities, said C. E. Parks, and the 5,000-mva. requirement may not be far distant.

Rate of Rise

B. P. Baker (Westinghouse) contributed the reminder that reduction in rate of rise of recovery voltage is conducive to consistency in interrupting performance over a wide range of current values. D. M. Jones (General Electric) stated that the higher ratings now available and in sight tend to remove present limitations to system design but that care needed to be taken not to overstep economic balance. He said the higher ratings preclude any economic feasibility of providing factory testing facilities large enough to obviate field tests; anyhow, the difficulty of translating laboratory tests with irrefutable ex-

T. G. LeClair, Commonwealth Edison; C. A. Powel, Westinghouse (president of A.I.E.E.); C. B. Kelly, Kansas City Power & Light

trapolation made actual system tests indispensable. Jones said the time was ripe to recognize the dominance of reclosure and to review the rating and de-rating pattern. A word of caution about extending data was also offered by H. V. Nye (Allis-Chalmers) and he added that the designs reported at the session closely follow the European pattern.

Sporn, who had been accorded high credit by several speakers for his sustained drive for bigger and better breakers, said he was pleased to see the virtue of reclosure now accepted. He rated the field test as a clinching proof of the competence of a new breaker and said that the progress had been such that de-rating factors could now be eliminated.

No matter how reliable the generators, transformers and line be rendered it is incumbent, Sporn said, on the breaker to surpass all of them because the ultimate protective device has no protective device to protect it. The breaker alone determines whether abrupt abnormalities can be handled without risk of catastrophic consequences to the system. There is no occasion, in Sporn's opinion, to relegate the oil circuit breaker to a waning position; his field tests showed its ability to keep abreast of competitive air. Right now his decision is for oil at the station and air out on the line but, later, air breakers may prove to be the winner in the contest for even higher ratings.

Protective Devices

Improved Fault Protection for Rural Distribution Systems. A. Van Ryan (Kyle Corp.).

Oil-recloser has minimum delay opening on first and second operations to clear transient faults and longer subsequent delay to allow blowing of sectionalizing fuse.

Graphical Method of Calculating Fault Currents on Rural Distribution Systems. F. W. Linder (REA).

Quarter circles of impedance and current in conjunction with "line-mileage" scales give accurate determination of faults.

Rectifier Relay for Transformer Protection. E. L. Michelson (Commonwealth Edison).

Eliminates faulty operation due to pulsating d.c. inrush currents. One functions on positive, other on negative pulse.

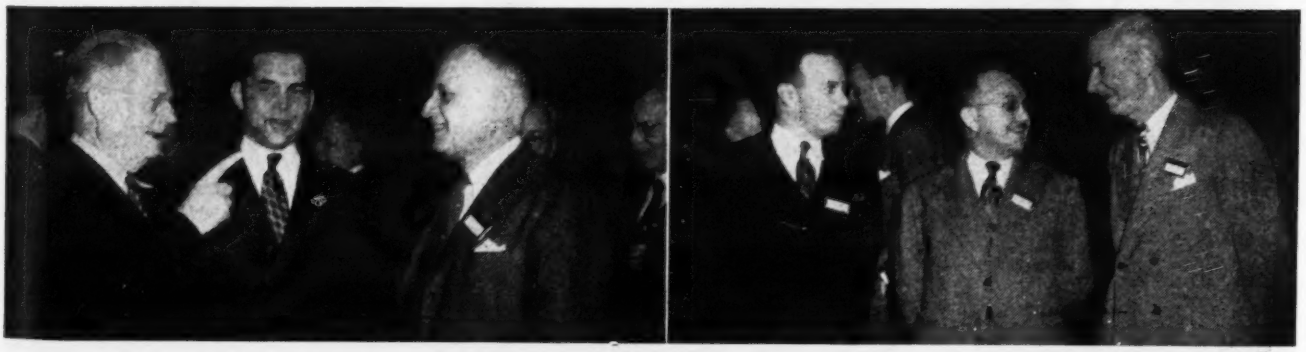
New Solenoid Mechanism for Magne-Blast Breaker. B. W. Wyman and J. H. Keagy (both General Electric).

Designed to close against the magnetic opposition of as high as 80,000 amp. of short circuit. Analysis of phenomenon and action.

Nine Years' Experience with Ultra-high-speed Reclosing of H. V. Transmission Lines. Philip Sporn and C. A. Muller (both Amer. Gas & Elec. Serv. Corp.).

Out of 635 flashovers (91 installations) reclosure was successful in 89.8 percent, 80 percent on one of two circuits. Advocates extension to lower-voltage lines. Supporting data.

Suggestions for amplification of Linder's procedure were offered through W. H. Hatch by his Public Service of Northern Illinois associates Andrews and Askey in commending the author's contribution. They felt that source short-circuit amperes could be indicated on the same dia-



R. W. Sorensen, California Institute of Technology; H. W. Hitchcock, Pacific Telephone & Telegraph; M. Eldredge, Surplus War Properties; J. S. Sawvel, Central Ohio Light & Power; R. A. Garbett, Crescent Public Service; C. W. Fick, General Electric

gram and that corresponding scales also could be introduced to cover substation and transformer impedances. Linder feared that the additions might clutter the otherwise simple charts with a multiplicity of lines and scales. He said the charts were devised primarily to facilitate the application of reclosers like that of the Van Ryan paper and to coordinate the fuse characteristics with the number and delay of reclosures. He answered a query about the 40-ohm fault-resistance value chosen by saying it was a fair practical-experience average of values stretching from zero to 1,000 ohms.

A Westinghouse device of 4 years' standing was mentioned by J. M. Wallace as comparable to the Kyle development reported by Van Ryan. Wallace added the thought that fuses can stand a comparatively unlimited number of non-blowing faults but that mechanical reclosers are subject to cumulative injury. Tests on fuses had indicated that a 2-sec. interval gave an increase in fuse-blowing time of about 5 sec. due to the intervening cooling. Wallace complimented the increase in range of application afforded by the recloser reported by Van Ryan.

Reclosure

Steady increase in high voltage reclosing breaker installations during the last decade on the A.G.& E. system, said Sporn, had unmistakably proven the efficacy of the practice. Performance on double-circuit lines is such as usually to permit carrying the load over the unfaulted line. High speed reclosure is his answer to simultaneous trouble on double circuits as well as affording the most economical means to enhance transmission reliability. However, out-of-synchronism may lead to 3-phase relay functioning without a 3-phase fault. Loss of synchronism, said S. B. Crary (General Electric), calls for minimum over-all time of tripping, opening and de-ionizing and he added that such good reclosure experience as reported by Sporn and Muller comes most likely from a system which has followed correlative modern practice in construction and operation. D. C. Prince (General Electric) said reclosure, while significantly effective, does not entirely supercede (1) the alternate line at a removed distance, (2) expulsion tubes and (3) the Petersen coil as contributors to transmission reliability. H. N. Muller (Westinghouse) asked whether selective pole reclosure could not have averted the instability reported.

In comment on the Michelson paper, W. R. Brownlee (Commonwealth & Southern) said that uncertainties of relays must not be allowed to upset the reliability of as eminently reliable a device as the modern power transformer. Fictitious indications of trouble tempt the operator to leave the unit unnecessarily out of service. He added that inrush troubles will be accentuated as more transformers with high permeability, oriented cores are applied.

Power Generation

Evaluation of Electric Distribution Losses in Terms of Generating Station Capacity Investment. Mario Mortara (Consol. G. E. L. & P. Co.).

Formulas and analytical procedure for choosing setup and rate of growth for most economical losses at time of peak generation.

Use of Dielectric Absorption Tests in Drying Out Large Generators. H. C. Marcroft (Penn. Water & Power).

Time-rate of change and magnitude of observed d.c. are superior indications of amount of absorbed moisture.

Frequency Changers—Characteristics, Applications and Economics. S. B. Crary and **R. M. Easley** (Both General Electric).

Discusses characteristics and comparative merits as to economics, disturbance isolation, losses, etc. of various sets.

Proposed Preferred Standards for Large 3,600 R.P.M. 3-phase, 60-cycle Condensing Turbo-generators. Joint AIEE-ASME Committee.

Six ratings, one or two T and psi. ratings for each, maximum of five extractions, 10 percent marginal capability, 85 percent power factor. Generator specifications included.

Tacit acquiescence was given at the session at which the joint committee reported new standard ratings for turbogenerators and the A.I.E.E. committee reported specifications for the generators. The joint report has been approved by A.S.M.E. and awaited corresponding action by the A.I.E.E. directors.

Ratings of 11,500, 15,000, 20,000, 30,000, 40,000 and 60,000 kw. are the decision and it is hoped that the consequent repetitive manufacture will reward the industry, although Chairman Oldacre reminded that rising prices might mask the saving in cost.

Such dissent as there was was couched in terms of suggestions for subsequent revisions. R. L. Webb said the characteristics of the Consolidated Edison system called for 0.80 p.f. generators, and added the re-

B. M. Jones, Duquesne Light; M. S. Oldacre, Commonwealth Edison; C. M. Laffoon, Westinghouse; J. F. Fairman, Consolidated Edison of New York; T. Fort, Westinghouse; R. T. Henry, Buffalo, Niagara & Eastern

C. W. Jones, New England Power; H. V. Erben, General Electric; T. Dugdale, Indiana & Michigan Electric; C. A. Muller, American Gas & Electric Service; E. B. Rietz, General Electric; W. H. Zilger, Line Material; S. P. Brady, Locke Insulator

minder that the generator with 15 psig. has capability 5 percent greater than the turbine at 0.85 p.f. For the exciter in the generator specifications he suggested that the air ports be above the generator floor to avert pump room humidity. F. W. Gay (Public Service Electric & Gas) urged the substitution of pull-out torque at maximum field and output for the stipulated short-circuit ratio (value $=0.8$). Faults are almost invariably cleared and with 150 percent pull-out torque the machine should ride through several seconds of fault. He saw no reason for some of the details incorporated in the generator specifications such as the presumption of a pilot exciter. E. E. George (Southwest Power Pool) seconded the pull-out suggestion and added that there was too much reluctance to derive the reactive benefits that would come with resort to high-pressure hydrogen. He said conditions are more and more forcing the larger units to take the load swings. J. B. McLean (Burns & Roe) said the standards were very appropriately timed, especially for industrials and the smaller utilities.

Loss Calculations

On Mortara's paper the comment was largely that it was academic. Harold Goodwin (Philadelphia) said it was not clear how much more than distribution losses was included; he said the long standing dilemma had been on how much weight to accord to the demand charge. R. F. Hamilton (Foreign Economic Administration) urged that most systems could profitably use more copper and that higher than base-load energy costs should be used in making economic comparisons based on losses. Gay favored a less academic approach than Mortara's and hinted that the gas turbine is appropriate as a small peaking unit near the load. Incremental value of improved economy is important and tends to favor carrying the peak near its physical origin. M. J. Steinberg (Consolidated Edison) questioned mathematical refinements which indicate a fractional year for delay period because of the seasonal character of the peak.

Higher than the 1,500 volts of Marcroft are used by Consolidated Edison on Class B-insulation machines said R. L. Webb; he advocated slow-drying at 75-100 deg. C. because higher temperature or shorter time may dry out only irregularly. They rarely dry a stator less than 72 hours. E. W. Whitmer (Amer. Gas & Elec. Service) has found quite a bit more spread as to both megohms and power factor between phases than from winding to ground (10 kv. d.c. for 10 minutes). H. B. Wolf said Duke Power, like New York, uses higher voltage for the sake of reading milli- rather than micro-amperes. L. J. Berberich (Westinghouse) asked why use a battery instead of one of the several hand or motor-driven generators in making insulation tests; Marcroft replied that he disliked the 2-5 megohm ballast in the leads and preferred his battery method because it has positively and permanently low impedance.

Machinery Insulation

Insulation Resistance and Dielectric Absorption Characteristics of Large A.C. Stator Windings. J. S. Askey and J. S. Johnson (both Westinghouse).

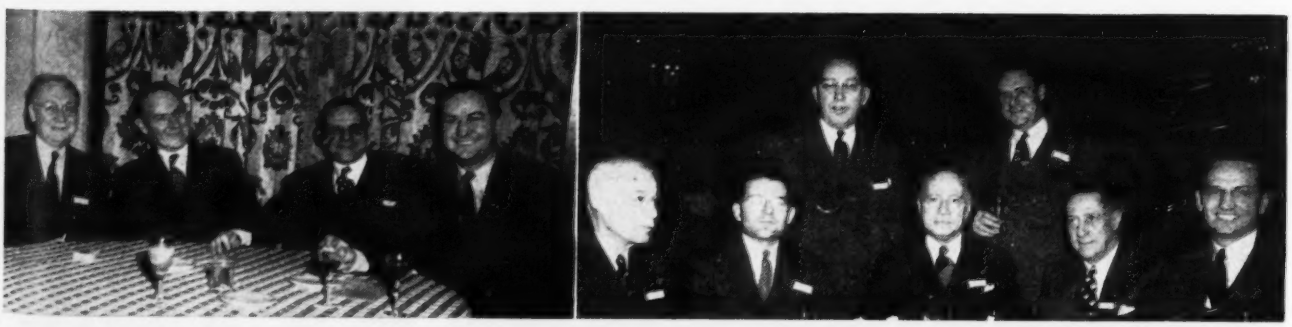
Treats the average and normal characteristics of new windings and safe minimum values of insulation resistance. Statistically supported.

Organo-Silicon Compounds for Insulating Electrical Machines. T. A. Kauppi (Dow-Corning) and G. L. Moses (Westinghouse).

Presents tabulated properties of new organo-silicones in fluid form for lubricants and bonding varnishes for higher grade Class B insulants. Urges re-examination of thermal endurance requirements of machinery insulations to establish economic place of silicones.

The Application of Silicone Resins to Insulation for Electrical Machinery. J. DeKiep, L. R. Hill and G. L. Moses (all Westinghouse).

Sustained tests indicate superior thermal endurance and stability. Silicone varnishes expected to protect electrical apparatus for 20 to 100 times as long as conventional organic materials at same temperatures. Silicone lubricants companion for motors. Suggest 40 deg. C. above Class B and limiting hot-spot temperature of 175 deg. C. for standards.



L. F. Hickernell, Anaconda Wire & Cable; C. T. Hughes, Connecticut Light & Power; H. G. Burd, Anaconda Wire & Cable; L. H. Anderson, Heyden Chemical; E. L. Adams and T. O. Rudd, Kerite Insulated Wire & Cable; R. H. Barclay, J. G. White Engineering; R. W. Harris, Kerite Wire & Cable; W. H. Dickinson, Standard Oil Development. Standing: C. B. Kelley, Kansas City Power & Light; R. B. Norton, Kerite Insulated Wire & Cable

Lynn Morrow and Robert Morrow, I-T-E Circuit Breaker; H. L. Hildenbrand, Easterline-Angus; W. H. Edmunds and W. Deans, I-T-E Circuit Breaker

Rating of High-temperature Induction Motors. P. L. Alger and H. A. Jones (both General Electric).

Optimum temperature rise for continuous rated motors asserted to be below 80 deg. C. even using silicone insulation; limitations also breakdown torque, size of shaft and bearings.

After studying failures of over 40 motors J. G. Noest (Consolidated Edison Co. of New York) can see a major application of silicone insulation with the hope that the differential in cost for the totally enclosed, fan-cooled motor over the open or drip-proof frame motor will be reduced at the same time that reliability of such motors is increased. His inquiry regarding abrasion resistance and solubility in lubricating oil had a response by G. L. Moses that no such trouble had been experienced by 50 motors ranging from 5 to 3,000 hp.

Silicone compounds in quantity, it was reported, will not be available until a production plant now going into operation by Dow-Corning is functioning. The present high price (said to be about $3.65 per lb. for solid resin and $15 per gal. for liquid) is expected to be reduced similarly as for other insulations in much the same way as it was in the case of neoprene. The varnish form is baked at 250 deg. C.

To questions by W. A. Del Mar (Phelps Dodge Copper Products Corp.) and A. L. Brownlee (Commonwealth Edison Co.) regarding operation of silicones under high voltages and resistance to ionization, T. A. Kauppi replied that no recommendations, due to lack of experience, can be made at present but they do know that it is ozone-resistant. Moses advised that silicone varnish now passes A.S.T.M.-oil resistance tests and applications have been limited to 4-kv. work, not any 12 and 22-kv. jobs yet.

The 175-deg. C. temperature limit is endorsed as it appears to be conservative by motor tests by Reliance Electric & Engineering Co., according to J. L. Fuller of that company. Relative to transformers, V. M. Montsinger (General Electric Co.) stated that the industry is not yet ready to use the high-temperature insulation.

Cables and Corrosion

The Dielectric Strength and Life of Impregnated Paper, IV. J. B. Whitehead and J. M. Kopper (both Johns Hopkins).

Ionization recorder detects beginnings of failure. Finds high-density paper has lower impulse strength.

Electrolysis and Corrosion of Underground Power System Cables. L. J. Gorman (Consolidated Edison).

Analyzes duct survey data to classify 8 kinds of corrosion of which duct and self-corrosion are worst; a.c. corrosion negligible.

Galvanic Corrosiveness of Soil Waters. H. S. Phelps and Frank Kahn (both Philadelphia Electric).

See article by the authors in the August 19, 1944, ELECTRICAL WORLD.

Study of A.C. Sheath Currents and Their Effect of Lead Cable Sheath Corrosion. C. M. Sherer (Penn. Water & Power) and K. J. Granbois (Safe Harbor Water Power).

Corrosion found accelerated by rectified alternating currents induced in sheaths by load current. Lead surface film rectifies.

The ionization recorder of Whitehead and Kopper was judged by W. A. Del Mar (Phelps-Dodge) to be a highly useful new tool and Herman Halperin (Commonwealth Edison) seconded the acclaim. Cable engineers of the manufacturers quite generally disagreed with the authors on the matter of impulse strength of high density paper—so much so that Dr. Whitehead wondered why they do not get together to find out why cables fail to meet the high standards his researches are setting. Differing also from manufacturers' engineers was L. I. Komives (Detroit Edison) who believes that high density near the conductor *does* increase impulse strength. Halperin brought out that oil-filled cable failures are generally radial whereas incipient failures in solid-type cables are usually longitudinal or spiral.

Some of the confusion about the merits of high-density paper was resolved by K. S. Wyatt (Phelps-Dodge) who pointed out that its shrinkage is several times as great in thickness as in length and that this could (unless tension is controlled) result in looseness and consequent variations in oil-film thickness which would account for the anomalies and disparities.

Sheath Corrosion

Whether a.c. electrolysis damage exists per se or merely modifies other influences was left an open question in the sheath corrosion discussion. However, there seemed to be concurrence that pH. values of the soil waters near the neutral band of 7 or 8 result in less injury than higher or lower values. The papers evidently presage an intensified study of corrosion phenomena, detection and prevention.

That Sherer and Granbois may have confused a.c. action with galvanic currents was opined by C. T. Hatcher (Consolidated Edison). On nearly a million feet of single-conductor 11-132-kv. cable there have been no failures directly attributable to a.c. electrolysis. In Chicago half the sheath

A. C. Monteith, Westinghouse; J. North, Commonwealth & Southern

failures in 5 years were attributable to cathodic corrosion; failures rose sharply at 10-12 year life, Halperin said. He calls it extremely essential to keep the sheath negative at all times, if possible. G. E. Dean brought from Public Service Electric & Gas the query whether Gorman's exploring electrode does not disturb the regime of duct and sheath currents. Detroit Edison, said W. D. Sanderson, tries to render ducts dry by lining with tar-paper at crucial points and cork-insert collars at mouths. Further, the concrete is vibrated to promote density and extra grease with added silicate of soda is applied.

R. C. Waldron (Okonite) said cable with protective covering in metropolitan ducts for 11 years shows no evidence of corrosion and no jamming, the pulling being as easy now as when installed. He said that any feared gaps in the coating accentuates only the stray-current form of damage, generally recognized now as the least prevalent cause. However, the papers and discussions brought out the experience that abandonment of trolley lines has tended to intensify other manifestations of sheath injury. Up to 1943 corrosion was given as the cause of one in four cable failures, said M. W. Ghen (Duquesne Light) and he urged that makes it a pressing field for study. Appearance of sheath is a good basis of diagnosis especially when test data fail to afford an adequate explanation, said A. S. Brookes (Public Service Electric & Gas). He was one who believes that a.c. potentials, even if they do rectify, cause trouble only by their influence in polarizing or masking other potentials.

Threading through the various discussions was the thought that the sheaths tend to develop their own protective coatings after a few years. Sherer and Granbois had pointed out that for new cables the rectified induced sheath currents are in the same direction as the galvanic currents; later they are in reverse direction and the corrosion wanes, particularly in heavily loaded cables.

Industrial Power

The Design of Busbar Industrial Distribution Systems. T. J. Higgins (Ill. Inst. of Tech.).

Epitomization of available data. Bibliography of 575 references appended and interpreted coordinatively in terms of respective contributions.

Dodge Chicago Plant's Electric Power Distribution Scheme with Airplane Engine Testing Power Recovery. E. L. Bailey (Chrysler).

Radial 460-volt distribution from 2,000-kva. unit substations with five units on each 12-kv. feeder. Square mile area has 90,000 kva. connected load with 39,000 kw. estimated demand. One-fifth of energy recovered from slip-ring induction generators coupled to engines. Power factor 90 percent derived by use of 300-kva. synchronous motor on ventilating-cooling fans.

Modern Electric Power Distribution Ideas as Applied in a Large War Plant. R. H. Kaufmann (General Electric) and **N. A. Kieb** (Pratt & Whitney Aircraft).

110-kv. supplies, 13.8-kv. primary, secondary selective, each load circuit has alternate independent source, load center unit substation. Two 20,000-kva. and one-10,000 kva. transformers, operation good.

Induction Heating of Moving Strip. R. M. Baker (Westinghouse).

Mathematical analysis of p.f., efficiency and penetration with machine and oscillator frequencies applied to thin strip moving up to 1,000 ft. per min.

Annotation and bibliography in the Higgins paper puts the designer of a bus in position, said S. C. Killian (Delta-Star) by letter, to execute his details in the library rather than in the laboratory. He added that the author's next logical step was a book collating all the foreign and American formulas; a show of hands evinced a substantial interest in such a book. It had been said by the author that much of the refinement in design was hidden in untranslated European literature; for example it seems not to be appreciated that Russian technology had enhanced the capacity of some buses by 20 percent by applying "equalizing sleeves." Several other producers of buses were represented as valuing the paper highly for its reference value. F. V. Andreae (Southern Ferro Alloys) related how important it is to get values of the reactance of furnace buses and leads down toward

M. D. Ross, Westinghouse; F. S. Brown, Duquesne Light; L. A. Kilgore, Westinghouse

the internal resistances of 0.001 and 0.002 of some furnaces.

J. D. Wright (General Electric) through L. A. Umansky in comment on the Bailey paper said the plant described exemplified wise practice in using the induction generator and series capacitor to achieve energy recovery up to 6,000,000 kw.-hr. per month in the engine testing. It thus repays $200,000 a year to the tax payer as well as providing a 20 percent return on the initial investment.

L. C. Peterman (Ford, Bacon & Davis) urged that more emphasis be put in the Kaufman-Kieb paper on the fact that this is a war-time plant not readily capable of being planned closely enough to achieve best utilization factors for cables and transformers. He also questioned the practice of connecting grounds through the messengers that support the fluorescent lighting units because of the possibility of heavy fault currents. He further construed the provision of two transformers at a load center as possible admission that forced cooling of the non-inflammable liquid in the transformers may lack somewhat in reliability. R. A. Goeller (Hatzel & Buehler) told of attaching a lamp and bell alarm to buses to give warning that loadings or temperature may be exceeding designed values because of successive additions of connected load.

Howard Melvin, Ebasco Services; A. M. Wainwright and H. M. Sliter, General Electric; Cecil S. Lynch, Arkansas Power & Light

D. P. Ashley and John A. Johnson, Long Island Lighting; C. G. Frei and W. D. Jennings, General Electric; E. J. Amberg, Connecticut Light & Power; C. A. Molsberry, United Illuminating; F. A. Faron, General Electric

Lightning

Impedances Seen by Relays During Power Swings With and Without Faults. Edith Clarke (General Electric).

Part I, construction of impedance chart; Part II, equations for charts; Part III, derivation of equations.

Lightning Investigation of 132-Kv. System. I. W. Gross and G. D. Lippert (both Amer-Gas & Elec. Serv.).

Station magnitudes in line conductors 2,400-11,500 amp.; in ground wires 1,700-10,300 amp., in arresters, 500-4,100 amp. Long ground rods more effective than counterpoises.

Lightning Investigation on Transmission Lines —VIII. W. W. Lewis and C. M. Foust (both General Electric).

Highest measured rate of change 550 kv. per ms.; voltages up to 525 kv. on limited line; overhead ground wire currents up to 36,000 amp.; arrester currents only 3,600; new surge resistance ratios lower.

It took a women engineer to achieve what many a male engineer has been seeking—namely, a visualization of the phenomena with which relays (especially distance relays) have to contend during power swings. In these terms high credit was accorded Miss Clarke for devising the impedance circles and now the relay man can reach for a chart and shun pencil and paper. The new tool, said H. P. Sleeper on behalf of A. R. V. Warrington is particularly timely because of the verging instability of heavily dutied war-load lines. Professor Kimbark of Northwestern identified the family of circles with the familiar ones associated with field patterns. F. C. Poage (Ebasco Services) typified the acclaim accorded the paper by stating that it crystallizes vividly the nebulous empirical guesses of the relay engineer when struggling with the relaying of swinging lines.

That present coordinative measures make it possible to render a station virtually lightning-proof was a conclusion drawn from the Gross-Lippert paper by J. H. Hagenguth (General Electric). He pointed out however that long buses tend to dilute their conclusion that a multiplicity of lines in or out of a station tends to create diverting paths for strokes. On the Lewis-Foust paper Hagenguth mentioned that the link recorder is a capacitance device that modifies the wave from what it would have been if unmeasured.

P. L. Bellaschi (Westinghouse) spoke of the 10-year devotion of committees to the benchmarks, one of which is the front-of-wave prescription in the standards. The megavolt per micro-second originally chosen seems still substantiated. Grounds he said, need further study.

Station Auxiliaries

Informal papers were presented at a conference intended to portray the trend of practice regarding station auxiliaries. Outstanding is the reported trend toward unit design of stations and use of 440 volts (up to, say, 100 or 150 h.p.) and 2,300 volts. Reliability of the transformer and of the transmission system in some instances prompts supply of auxiliaries from the system. Full-voltage starting is practically the rule. "Voltage chasing" schemes are not considered necessary in general. There is a growing disposition to put more than one motor on a breaker to save breakers.

Difference of opinion involves (1) the shaft and house turbine as contrasted with off-the-leads supply of auxiliaries, (2) the reliability of adjustable speed drives versus the wound-rotor motor and (3) the potential merits of a network supply. On the latter considerable savings were effected in a recent station design by adopting 4 kv. and 440 volts as well as sticking to the simpler radial system.

Space for auxiliary switchgear is competed for by growing duct and pipe systems. Sequential protection is indicated by the efforts to couple reliability with simplicity. One partially unanswered query was "what to do when system frequency starts to slip and the auxiliaries all begin to lie down?"

Electric Welding

Analysis of Arc Welding Reactors. C. M. Wheeler (General Electric).

Develops design formulas for family of reactors associated with magnetic frame of d.c. welding generator for optimum proportions of turns, core dimensions and air-gap to stabilize current.

The Power Distribution Problem in Arc Welding. H. W Pierce and C. E. Smith (both New York Shipbuilding).

Six 1,500-amp. d.c. generators per way, each serving 120 production welders (180 amp. average over 200-ft. cable) and 60 to 80 tack welders. A.C. impracticable because of vertical or overhead work.

Power Supply for A.C. Arc Welding. A. U. Welch and R. F. Wyer (both General Electric).

Discussion of industrial duty, switching transients, p.f. correction, duty factor.

Analysis of arc welding reactors raised two questions. The first by Prof. G. H. Fett (U. of Ill.)—How is the required inductance determined without resorting to a multiplicity of tests? Wheeler's reply indicated that best results were obtained by performing the tests and having these results determine the inductance value. H. N. Muller (Westinghouse) gave a short explanation of the Navy empirical formula to determine this value. A second question by Muller whether studies have been made to determine the effects of various types of iron in the core brought a negative answer.

Power distribution in supplying the arc welder is of utmost importance stated R. F. Wyer, but too much emphasis is placed on the lead length. Shop tests have shown that a.c. weld-

ers can be adequately served up to 250 ft. from the supply center by using the steel floor as the return.

C. E. Smith stated that the air breakers which are used to protect each circuit are a justifiable expense since faults are localized.

"Bites" and "nips" which make it difficult to keep women on the welder jobs are of concern to the Western plants stated Prof. C. F. Dalziel (U. of Cal.). Suggestions such as changing damp gloves and using insulated rod changers were offered by Wyer to overcome their objection to minor shocks.

More information on welder performance to assist the power sales engineer and on load diversity where two or more units are served by one transformer to assist the distribution engineer was urged by C. N. Clark (Duquesne Light) and H. E. Smith (Commonwealth Edison).

Conference on Relay Protection of Generators

Direct grounding and impedance grounding and the resulting effects on relaying were the primary topics and issues at generator relaying conference. Two schools of thought were expressed on clearing a machine from the bus; one involves simultaneous tripping of all breakers and the second, sequence tripping of the breakers. Trend is toward high speed relays but it was brought out that not too much is known about the benefits derived from the one-cycle operation of that type over the older five-cycle induction type.

More information was reported to be needed on length of time of field decay and the proportionate amount of stator iron burned during the fault.

The three informal papers presented brought out the protection advances that has been made in past ten years. Most differential protection applications at the present time are reported as covering only phase-to-phase and phase-to-ground faults. It was indicated that turn-to-turn fault protection can be provided on parallel winding generators by bringing out the necessary leads.

Instruments and Measurements

Orthomagnetic Bushing Current Transformer for Metering. A Boyajian and G. Camilli (both General Electric).

Greatly reduced C. T. errors by superposing 180-cycle excitation in conjunction with auxiliary burden and phase-angle compensating impedor and thus obtaining linear magnetic characteristics and constant, compensable errors.

A Modulated Frequency System of Telemetering. H. E. Renfro and A. P. Peterson (both Control Corp.).

Seattle's high-speed visual telemetering based on improved control and measurement of frequency.

Dynamic Measurements on Electromagnetic Devices. E. L. Norton (Bell Tel. Labs.).

Bridge method takes point-to-point readings of current-time, fluxtime, etc. on d.c. microammeter.

A Portable Instrument for Measuring Insulation Resistance aa High Voltage. F. W. Atkinson and R. B. Taylor (both the Takk Corp.).

Employs new cold-cathode rectifier to construct 31-pound d.c. test set for up to 2 ma. and 9 kv. Suitable for cables, generator windings, etc.

Commenting on the Boyajian-Camilli paper, E. C. Wentz (Westinghouse) indicated he thought the scheme described would result in a rather complicated set-up, as it required individual matching of C.T. impedances to burdens by means of the external autotransformer and auxiliary burden. S. D. Martin (General Electric) pointed out that the imposition of the higher frequency kept the core demagnetized and thus acted as protection against the effects of heavy fault currents that sometimes impaired C.T. accuracy. F. B. Silsbee (U. S. Bureau of Standards) said he would like to see the effects of higher frequency imposition in some typical observed hysteresis loops. C. A. Woods, Jr. (Westinghouse) cited sacrifice of simplicity and ruggedness and necessarily more careful adjustment of impedance to burden as the cost of improved performance by the proposed C.T.

The frequency method of telemetering is now restored to its place in the art, observed P. A. Borden (Bristol Co.) in reference to the Renfro-Peterson paper.

High Voltage D.C. Testing

Discussion of the Atkinson-Taylor paper centered almost exclusively on possibilities of application of the described instrument to the testing of power system equipment, generator windings, particularly. This was brought up by R. L. Webb (Consolidated Edison), who detailed the procedures of such tests. Insulation testing of large machines should be done at voltages comparable to ratings and in this respect, said J. S. Johnson (Westinghouse) the new tester is a real advance over low voltage testing methods. L. J. Berberich (Westinghouse) seemed to think the drooping voltage characteristic of the new rectifier tube might be troublesome in time-current insulation tests and he wanted to know if backfires in the tube would cause difficulties. T. B. Whitson (J. G. Biddle Co.) commented that the tester in its present form would probably be especially useful on bushings and other low capacitance parts. Closing the discussion, Mr. Atkinson said that the present form of the instrument was not designed to be a dielectric absorption tester, but could readily be developed into one. Backfires do no harm to the tubes, he reported, and tube life is unknown; some of them have been in use for four years and apparently are as good as ever.

C. E. Fishbeck, Detroit Edison; K. S. Wyatt, Phelps Dodge Copper Products; J. W. Weight, Electric Storage Battery; S. P. McDaniels, Westinghouse; Don Corson, Cornell-Dubilier; Edward Martin, O.Z. Electrical Manufacturing; E. F. Coffey, "Electrical World"; Richard Kent, Cornell-Dubilier

Arc Welders Are Coming on Farm Service Lines

Farmers are discovering the usefulness of arc welding around the place and when the war is over welders can become a serious problem on rural service systems—But they need not be

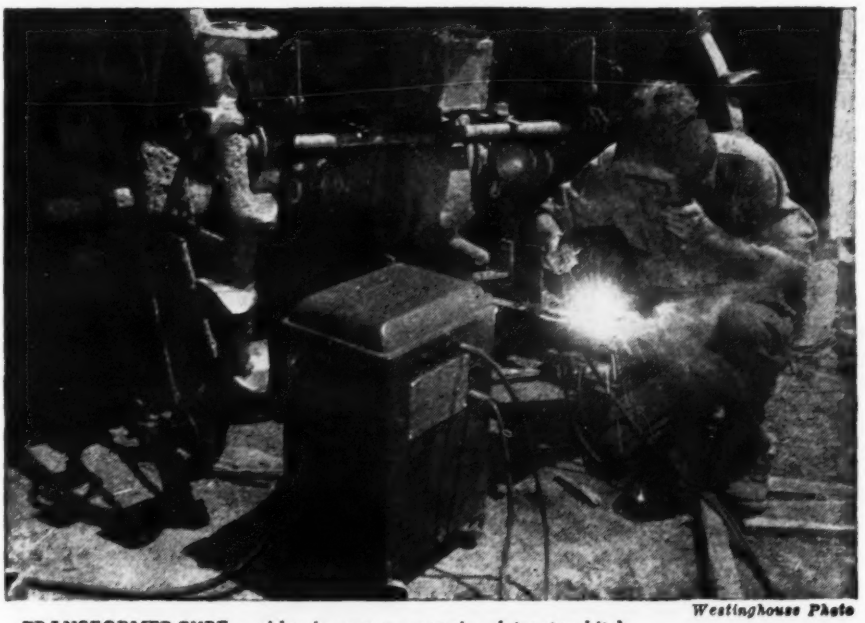
POSING A PROBLEM for utilities and for REA cooperatives, appears now the prospect of large post-war increase in the use of arc welding by the American farmer. With arc welding the farmer can quickly repair a broken machine part at a critical time when interruption of the machine's work might be costly. With a few pieces of scrap iron he can put together frames, racks and braces. He can hard-face plowshares, rollers, tractor rails. He can build a wagon or a trailer from a junked motor car. There are innumerable ways for a farmer to use arc welding. And from indications now apparent he is going to use it.

In the post-war readjustments of employment many men familiar with welding will find their way back to the farms. About a half million men trained in welding will return from the armed services. Around 140,000 boys are now taking arc welding courses in vocational schools.

Manufacturers are seeking out and noting for the record the many and varied uses the farmer can make of arc welding. They are investigating markets, considering allowable price range and getting ready to offer welding equipments especially designed for farm work.

All of this adds up to a problem for utilities and cooperatives. Will they welcome on their lines a load that will be difficult, to say the least? Or will they try to discourage it, pointing out that a welding generator driven by a gasoline engine or by a power take-off can do the work as well?

Some illumination of the problem comes from a survey recently made by the Rural Electric Information Exchange which is sponsored by the magazine *Farm Journal*. From 36 states came 73 survey replies. Most of the reports came from agricultural schools and from experiment stations and extension services of the U. S. Department of Agriculture. The others came from utilities and farm management organizations.



Westinghouse Photo

TRANSFORMER-TYPE welder in use on repair of tractor hitch

Welder Market Estimates

An impressive preponderance of the replies indicates that their writers do expect that after the war there will be a large increase in use of arc welding on farms. Less than 10 said or implied that the prospect was not important. Estimates as to the probable market were extremely variable. Highest estimate of 750,000 farms, over 12 percent of all in the country, was agreed on by 2 of the replies. Next came 3 with a guess of 5 percent of farms, presumably all farms, with and without electric service. Largest agreement was that of 7 replies estimating 10 percent of all electrified farms. Other replies offered estimates in figures ranging up to several hundred thousand, but not so clearly specified as to be statable in proportions to the national total of farms. A general conclusion to be taken from the replies is that if all the welders sold to farms after the war are connected to rural service electric lines there will be plenty of trouble with voltage regulation and burned-out transformers unless special provisions to serve the load are made.

But probably it is not necessary to think of welders on farms in such terms. Obviously the welder is not a piece of farm equipment like a water pump, say, for which every unsold

farm can be regarded as a potential buyer. Quite likely one farmer, maybe an average of one per township as was suggested in one reply, will do welding for a number of neighbors. Joint ownership of a welder by a group of farmers is another probability. And there can be no doubt at all that arc welding shops in villages and crossroads hamlets will multiply and flourish as the green bay tree. come post-war.

Consensus of the replies seems to be that a 100-amp. welder is necessary for satisfactory work on the farm. A few indicated a larger size would be desirable and one said 50 amp. would be enough. However, the point of most concern to the operators of farm electric lines is the kind of welder the farmer will want. The transformer type got the most votes —40 of the 73 replies—because of its lower cost and simpler design. Only 12 said the rotating machine would be more satisfactory. Thus it appears that most farmers when thinking about arc welding have in mind an equipment to be connected to electric service. This may not necessarily result in his buying that kind of a welder, however. When he learns that a larger transformer will probably have to be installed for his service and that he'll have to pay a monthly bill several dollars more than before, he may decide that a generator tractor-driven is a better bet.

Lincoln Electric Photo

WASHERS WELDED on sides of sprocket teeth to hold drive-chain on hay elevator

Various opinions were expressed as to how much the farmer would be willing to pay for welding equipment. On a "not more than" scale, the line-up of replies is as follows:

Not More Than	Replies
$350	1
200	1
150	26
100	20
50	6
40	4

The amount of mechanical equipment the farmer has will be the largest determinant of whether or not he will buy a welding outfit. This was agreed on by 39 of the replies. A mechanically-minded son or hired man could be the determinant in the opinions expressed in 30 of the replies. Convenience to a town where repairs might be made was a consideration in 18 of the replies. Acreage and kind of farm were seen as lesser factors. Apparently the reason any farmer will buy a welder will be a combination of many considerations, principal among them being the amount of machinery he has and the presence of a welder operator.

General Electric Photo

FARM MACHINE being repaired in welding shop

In general, rural service lines are not designed for supplying energy to welding equipments. If welders are bought by farmers and connected to the lines indiscriminately, they will cause a lot of trouble not only to the utilities or cooperatives concerned but also to the farmers themselves and to their neighbors. The average farm service transformer is not large enough to handle an arc welder of a size satisfactory for farm use. In many cases the line conductors will not carry the welder load without excessive voltage drop. If the service is strengthened to carry the welder load satisfactorily then the increased investment requires higher charges which the farmer will not like.

Therefore, in view of the probability that electric welders will soon become a fairly common tool on American farms, it seems advisable that operators of rural service lines should inform their customers of the necessity for proper selection of welding equipment and of the special service provisions required for it. Otherwise there will be a lot of burned-out transformers and a lot of farmer customers dissatisfied with both the welders purchased and the connected electric service.

Over against this consideration of the trouble that welders may cause on farm lines, there is another matter to which the utility or cooperative could give some very serious thought. This is the fact that average farm service capacities are small because average loads are small. If a farm has a three-phase connection through a 10- or 15-kva. transformer serving a good-sized load then the addition of a welder won't make much difference. Or the situation might profitably be viewed in reverse. If a 10- or 15-kva. transformer is installed to care for a welder, then there will be a compulsion on the farmer to increase his other uses of electricity so that he'll get full value for what the service costs him, a compulsion also on the utility or the cooperative to sell the farmer those other uses. A 10-kva. transformer, idle most of the time, can be a powerful urge to load building. Might be that for the utilities the arc welder load on the farm could turn out to be a blessing in disguise.

Cable Test Program Uses Portable Kenotron Set

D. C. test preferred on grounds of cost and bulk equipment also affords a.c. testing—Incipient breakdowns detected—Faulty splices discovered—No failures attributable to manufacturing defects.

JOHN C. PARKER,* Memphis Light, Gas & Water Division, Memphis, Tenn.

USE OF HIGH POTENTIAL dielectric tests in the field, for locating defects in the insulation of power cable circuits, has been very successful. These tests may be made with either alternating or direct current but the latter is generally used when available.

The preference for d.c. equipment is based upon lower cost and smaller size. For instance, a circuit consisting of 2¾ miles of 27-kv. paper-insulated lead-covered cable was installed in 1940. The standard acceptance test required either an a.c. test set having an output of 50 kv. and 1,500 kva. at a leading power factor of 2 percent or less, or a d.c. set having an output of 120 kv. and 30 kw. Actually the output of a d.c. set, when testing this circuit, is less than 100 watts. However, with a d.c. test set it is necessary to have a current output greater than required for test, in order that any fault resulting from the test may be reduced to a continuous stable carbonized path. This path is necessary in locating the faults with a bridge or by tracer signals.

Equipment for applying high voltage dielectric tests to power cable circuits on the average electrical distribution system must be portable. Cable circuits terminate at many points and the cost of permanently installed test equipment at each of these points would be prohibitive.

A.C. dielectric tests have the advantage that by using suitable instruments, shielding and technique, the power factor, dielectric loss and the ionization factor of the insulation of the power cable circuit under test may be determined. D.C. tests have the advantage of indicating the dielectric absorption and insulation resistance of the power cable circuit under test. The value of power factor, dielectric loss and insulation resistance measurements is questionable in the case of long cable circuits since the results obtained are average values for the whole circuit and give no indication of weak points.

FIG. 1—Trailer houses Kenotron test equipment for power cable circuits

For high voltage dielectric tests on power cables we use a trailer-mounted d.c. cable test set (Fig. 1). This test set requires a 60-cycle single-phase 2-wire supply having a capacity of 37½ kva. at 240, 2,400 or 7,200 volts. It has a maximum 2-wire d.c. output of 120 kv. at ¼ amp. or 50 kv. at ½ amp. and a 3-wire d.c. output of 75/150 kv. at ¼ amp. Output voltage is continuously variable from zero to maximum by means of an induction regulator. Instruments are provided to indicate the output voltage and record the output current. The schematic diagrams, (Fig. 2), show connections of the set and test connections to various types of cable.

This test set is suitable for applying high voltage d.c. dielectric tests in accordance with standard specifications to power cable circuits having a voltage rating of 27 kv. or less, regardless of type or length. It may also be used for a.c. dielectric tests with a maximum output of ¼ amp. at 90 kv. However, the test set has no provision for making the measurements during a.c. tests that are necessary in determining power factor and dielectric loss of the insulation.

Cable tests described herein are made at maximum test voltages applied for the maximum time permitted by the current AEIC and IPCEA Power Cable Specifications except as otherwise noted. Many cable circuits consist of cable of several sizes, types and/or voltage ratings that require different test voltages. Such circuits are tested at the voltage necessary to test the cable requiring the lowest test voltage provided that this cable represents over 10 percent of the total cost of the cable in the circuit. Where it is not practical to disconnect all equipment from cable circuits during tests, it is often necessary to reduce test voltages to prevent damage to equipment insulation. Test results and operating experience indicate that these test voltages are adequate. On every circuit tested, the test failure rate decreased with the number of tests on the circuit, provided failures due to cable sheath damaged from external sources, were omitted. This indicates that test voltages are not excessive.

On August 7, 1940 the first tests were applied to power cables of the Memphis Light, Gas & Water Division's, electrical distribution system. By November 1, 1944, 420 tests had been made including 49 acceptance tests on new cable.

Our schedule of cable tests calls for

* Supervisor, Kenotron Test Department

acceptance tests on each new cable circuit and annual periodic tests on all cable circuits. Unfortunately we have been unable to adhere completely to this schedule but we hope to in the future. Acceptance tests have been made on all new cable circuits and 90 percent of our cable has been tested at least twice. Being unable to follow the testing schedule, the selection of circuits to be tested has been based on importance and apparent condition of the cable.

Careful examination of test failures indicated that in every case there would have been a service failure if the defective insulation had not been located and repaired. In most cases it is impossible to determine how long defective insulation located by test would have operated before failing in service. However, we know that some defects located during acceptance tests would have failed when the circuit was energized and others would have operated a year or more before failing.

Faulty workmanship resulted in 70 percent of all test failures. Splice failures resulting from faulty workmanship were due to the following defects:

a. Sharp points of solder left on the connector.

b. Voids left in the connector slot and between the connector and the conductor.

c. Factory insulation accidently cut while stepping.

d. Factory insulation of multiconductor cable broken at the crotch.

e. Moisture left in splice by splicer.

f. Incorrect termination of shielding tapes.

Pothead failures resulting from faulty workmanship were due to the following defects:

a. Incorrect termination of shielding tape.

b. Faulty sealing of solder sealed potheads.

c. Entrance of moisture due to improperly seated gaskets.

We have not had a failure due to manufacturing defects in cable, potheads or splicing materials.

New cables and splices that withstood an acceptance test at full test voltage have not failed in service nor on subsequent tests. However, in every case where acceptance test voltage was reduced, to prevent damage to insulation of equipment that could not be isolated from the cable circuit during test, there have been either service or test failures in the cable or splices of the circuit. The only failures in potheads that withstood full acceptance voltage have been due to defects that did not exist at the time of the acceptance test.

Excessive current input into cable circuits during several tests indicated defects in circuits that withstood test voltage. These defects were located and repaired, thus guarding against a later failure.

The majority of test failures have reduced to continuous stable carbonized paths suitable for fault location with bridge measurements. A Murray Loop Bridge was used for locating stable faults between conductor and sheath or between two conductors where cable lengths and sizes were accurately known and the termination of the cable permitted looping a good and a faulted conductor. Fault locations made with the bridge were usually verified with a tracer signal. Where it was impractical to locate faults with the bridge, one of the two types of tracer signals was used. One signal was produced by charging a 2-mfd. condenser to not more than half test voltage and discharging it into the fault approximately once a second. The other signal was obtained by passing a 60-cycle current of 25 amp. through the fault and interrupting the current about once each second. Either signal was picked up with an exploring coil and head phones. Although low resistance faults were easily located with either of these signals, it was very difficult to locate high resistance faults. Condenser discharge signals are preferred since they do not destroy as much evidence of the cause of the fault as the other signal.

D.C. cable tests have been very useful in checking work before acceptance. Many defects in cable circuits that would have resulted in service failures have been eliminated by test, and great improvement in workmanship on cable circuits has resulted from the facts brought out by cable tests. We are therefore continuing our program of acceptance tests on all new circuits and annual periodic tests on existing circuits.

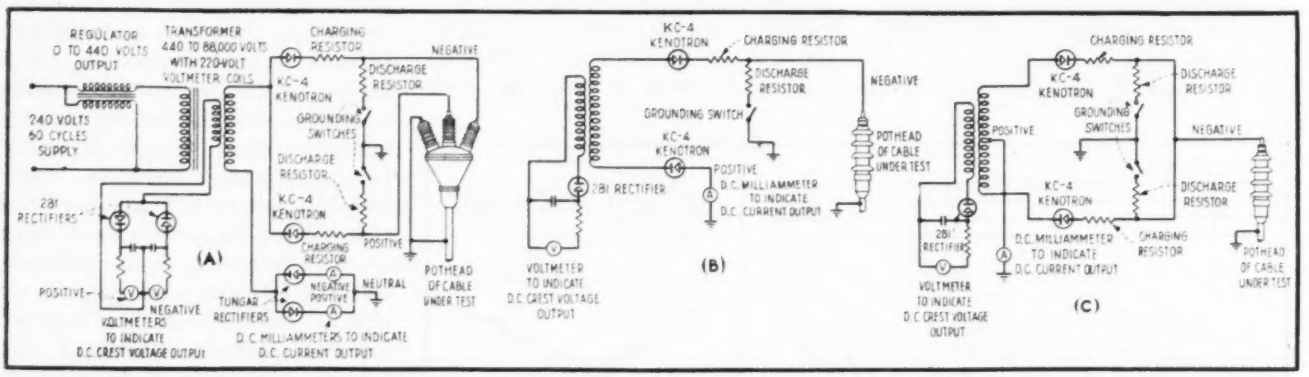


FIG. 2—Varying d.c. outputs derived by altering rectification and connections. *Connection A:* **Maximum 0.25 amp. and 150 kv. positive to negative, 75 kv. positive and negative to neutral; half-wave rectification. For testing multi-conductor non-shielded cable.** *Connection B:* **Maximum output 0.25 amp. and 120 kv.; half-wave rectification. For testing single-conductor and shielded cables.** *Connection C:* **Maximum output 0.5 amp. and 60 kv.; full-wave rectification. For reducing cable faults.**

(a) Each phase of circuits consisting of single conductor and/or shielded cable shall be tested separately with the other phases grounded using test set Connection B

(b) Cable circuits containing 3-conductor non-shielded cable shall be subjected to three tests using test set Connection A and the following connections to the cable: 1. Phase A, negative; Phase B, positive; Phase C, grounded. 2. Phase B, negative; Phase C, positive; Phase A, grounded. 3. Phase C, negative; Phase A, positive; Phase B, grounded. These connections result in the application of test voltage between conductor and sheath and twice test voltage between conductors.

(c) Grounding switches are open only when the transformer is energized.

Serve 2,300-V. Load from a 4,160-V. Bus

Transformers with standard ratios and adapted for 3-wire service can be connected to give approximately 2,300 volts—Primary and secondary connections explained and illustrated

G. A. WRIGHT, Moloney Electric Co., Indianapolis, Ind.

WHEN ELECTRIC distribution systems are changed from 2,400 volts delta to 2,400/4,160Y, there frequently are cases where three-phase 2,300-volt motors are involved and some provision has to be made for their supply. Other cases occur where 2,300-volt motors are moved from one location to another. If such motors cannot be reconnected, or reconnection is not considered desirable, then transformers are required to provide the three-phase 2,400-volts supply.

Special 2,400-2,400-volt single-phase transformers are sometimes purchased for this purpose, and connected star on the primary and delta on the secondary to provide the motor supply. The least expensive provision may be had by the purchase of a three-phase core-type auto-transformer of voltage 4,160Y/2,400Y. Such an auto-transformer has only about one-half the equivalent kva. parts of a corresponding two-winding transformer to do the same job, and therefore the auto-transformer costs much less.

However, if there is any indication that the three-phase 2,300-volt load is not to be of permanent nature, it is possible to make this transformation by another method using three standard-ratio distribution transformers. Then if the 2,300-volt load disappears these transformers can be used in regular lighting or power service. On the other hand the special 1:1 ratio transformers or the 3-phase auto-transformer would have to be rewound to be of service in a different application.

Auto-transformer Connection

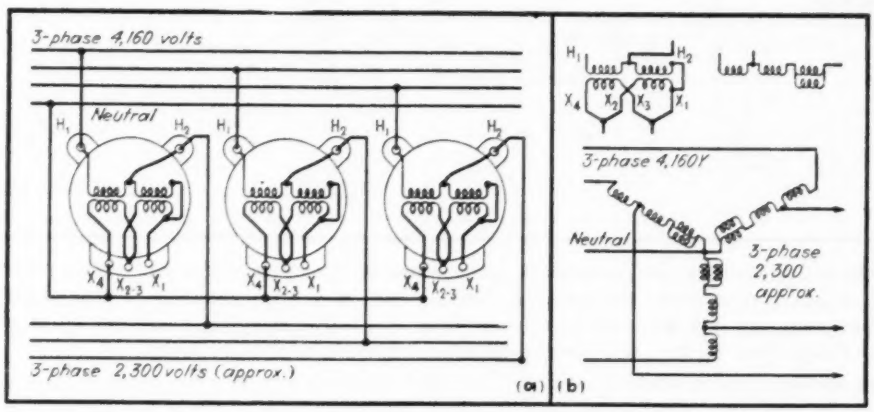
The method of making this transformation with standard ratio distribution transformers uses 2,400-120/240 or 2,400-240 by 480 volt, single-phase units in which the midpoint of the 2,400-volt winding is available inside the transformer. In each transformer, the H_2 lead is disconnected from the end of the winding and is connected onto this midpoint of the high voltage winding. Next a jumper connection is made inside the transformer from the H_2 end of the high voltage winding to X_1 lead. This connects the transformer as though it was to be used for booster service. Then the low voltage winding is connected for 240 (or 120 or 480).

The three transformers may now be banked with the H_1 leads going to the 4,160 volt buses, and the three X_4 leads tied to the primary neutral bus. A three-phase voltage of approximately 2,300 is available from the three H_2 transformer leads. This is not an exact 4,160 to 2,300 or 2,400-volt transformation, and the output voltage varies with the low voltage connection used. However, 2,300 volt motor loads are not as critical as to voltage as are lighting loads and the connection as outlined should be satisfactory.

L-V. Coil Connections

If transformers are purchased with this connection in mind, the manufacturer would supply a design which is suitable for it; but if it is expected to use some transformers already on hand, it is advisable to consult the manufacturer regarding them. There are certain conditions where units of 120/240 low voltage have to be made unsuitable for 3-wire service (by changing some coil connections) to be used in this kind of installation. In such cases it is possible that the halves of the low voltage windings would definitely have to be connected multiple instead of series or multiple being optional. Similarly, certain 240/480 volt units might have to be changed for the same reason. There are transformers with low voltage of 240 and 480 which are actually suitable for 240/480 volt three-wire service; for example, a bank of transformers supplying three-phase 480 and three-phase 240 volts simultaneously.

Transformers with Scott taps in the 2,400-volt winding are especially suited for this connection since their characteristics are necessarily right and the midpoint of the high voltage winding is already available to an external connection.



CONNECTIONS SHOW how three transformers of standard distribution ratio can be connected as auto-transformers and banked to supply three-phase, 2,300-volt load from a 4,160-volt bus. Physical connections are shown in sketch (a) and are illustrated diagramatically in sketch (b)

Industrial Capacitor Application Calculations—II*

Calculations for determining limiting size of capacitor to be connected to secondary bus without establishing resonant condition—Steps in prevention of excessive harmonic currents outlined

JOSEPH S. FRANCIS and STEPHEN FREEMAN, JR.,† Consumers Power Co., Jackson, Mich.

THIS IS THE SECOND of two articles dealing with installation of industrial capacitors from the standpoint of the electrical power supply system and continues the story of the process used by one company to determine the maximum industrial capacitor kva. which may be permanently connected at any one place on its distribution circuits.

Calculations to determine the possibility of harmful harmonic current resulting from installation of capacitors on industrial power systems should be made in all cases. Most troublesome of these possible harmonics are usually the fifth and seventh, 300 and 420 cycles respectively. In the voltage wave form at distribution substation buses there may be 2 percent to 3 percent of fifth harmonic and a smaller amount of seventh harmonic. In the excitation current of iron-cored transformers, there is also a percentage of fifth and seventh harmonic voltages which may or may not add to the harmonic voltage in the system wave form. Neither of these possible sources satisfactorily explain all of the observed cases of excessive current and voltage from harmonic sources.

Resonance Infrequent

In the authors' experience, no case of harmonic resonance has appeared except where 230 or 460-volt capacitors were connected to the low voltage side of transformer banks or to power secondaries having fairly large 60-cycle ratios of reactance to resistance. As yet, no harmonic resonance trouble has been experienced with capacitors connected directly to distribution circuit primaries.

On the Consumers Power Co. system, the danger of excessive voltage or current from harmonic sources appears to occur only when harmonic voltages are increased by capacitors installed so as to be in series resonance with a part of the supply circuit.

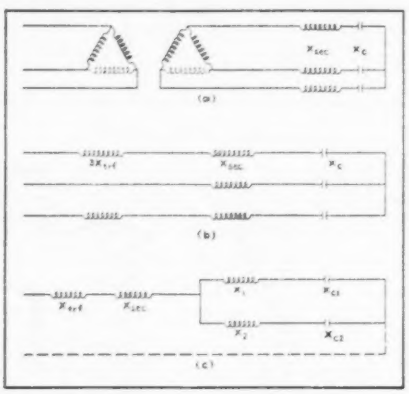


FIG. 1—Capacitors connected to the secondary of an open delta or open-wye transformer bank as in (a) may be represented by the mathematical equivalent (b). Secondary capacitors added to branch circuits served from a secondary bus may be represented by the equivalent line to neutral circuit (c) above

Consideration of these factors, study of the equivalent circuit and experience with capacitors which have given trouble has led the authors to believe that most of the harmonics which cause excessive capacitor current, at least on this system, originate in customers' transformer banks. If this is so, the electric circuit to be checked for harmonic resonance for secondary capacitors consists of the customer's power transformer bank, the power secondary run to the capacitors, if any, and the capacitors themselves. Tests of circuits showing excessive harmonic currents indicate that calculations of resonant frequency using these factors agrees closely with observed currents and voltages, and is sufficiently accurate for use in predicting corrective measures. This circuit which is a part of the equivalent circuit whose constants are already set up in Part I of this article should be tested for resonance by the well-known formula:

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

where f_r is the resonant frequency, L represents the inductance in henries of the circuit to be considered, and C is the capacitance in farads of the proposed capacitor bank; all of these values being line-to-neutral values. Inductance and capacitances used above are determined from the circuit reactances by the standard formulas given below:

$$X_L = 2\pi fL \text{ or } L = \frac{X_L}{2\pi f}$$

$$X_C = \frac{1}{2\pi fC} \text{ or } C = \frac{1}{2\pi f X_C}$$

Where X_L = circuit reactance at normal power frequency,
X_C = Capacitor reactance at normal power frequency,
f = the power circuit frequency.

Experience again has led to the belief that it is highly desirable that the calculated resonant frequency value for such secondary circuits shall equal or exceed 600 cycles in proposed capacitor installations. Whenever resonant frequency calculated is

* This is the second of two articles by the authors dealing with calculations involved in major industrial capacitor installations. Part I appeared in ELECTRICAL WORLD, January 6, 1945

† Electric Distribution Engineers

One line	Circuit constants	Apparatus	Equivalent circuit reactance - X Line to neutral values	Explanation of symbols	Equiv. circuit	Calculations (Line-to-neutral ohms)
System	5-KV. unreg. bus	Generator	$\frac{\%\,X_{gen.} \times 10 \times \overline{KV.}^2_{rated}}{KVA_{gen.}} \times \frac{(KV.)^2}{(KV_{op})^2}$ or $X_{gen.} \times \frac{(KV.)^2}{(KV_{op})^2}$	KV_{rated} = nameplate rated voltage	System	X System = $\frac{1000 \times 5.0^2}{400{,}000} = 0.000576$
	400,000-KVA. short circuit			KV_{op} = nominal system voltage on which equipment is operated		
	3%-5KV. 450 A.			KV. = desired voltage base for calculation		X Reactor = $\frac{3 \times 10 \times 5}{\sqrt{3} \times 450} \times \left(\frac{0.48}{4.8}\right)^2 = 0.001924$
		System bus	$\frac{\%\,X_{sc} \times 10 \times \overline{KV.}^2}{100{,}000}$ [100,000 KVA. base assumed] or $\frac{1000 \times \overline{KV.}^2}{KVA_{sc}}$	$KVA_{gen.}$ = rated generator output		X Regulator = $\frac{1 \times 10 \times 5^2}{260 \times 10} \times \left(\frac{0.48}{4.8}\right)^2 = 0.000962$
R	260 KVA. 10 %-5 kV			$\%\,X_{gen}$ = percent generator reactance		X Primary = $\left(\frac{5400}{5280} \times 0.714\right)\left(\frac{0.48}{4.8}\right)^2 = 0.007305$
	5400'-2/0 54" Sp.			$X_{gen.}$ = rated generator reactance (Subtransient values preferable)		$\left(\frac{1800}{5280} \times 0.686\right)\left(\frac{0.48}{4.8}\right)^2 = 0.002335$
	1800'-4/0 54" Sp.	Reactors	$\frac{\%\,X_{react.} \times 10 \times KV._{rated}}{\sqrt{3}\, I_{react.}} \times \frac{(KV.)^2}{(KV_{op})^2}$	$\%\,X_{sc}$ = system short circuit reactance		$\left(\frac{1300}{5280} \times 0.728\right)\left(\frac{0.48}{4.8}\right)^2 = 0.001792$
	1300'-4/0 54" Sp.			KVA_{sc} = system KVA. short circuit		$\left(\frac{200}{5280} \times 0.728\right)\left(\frac{0.48}{4.8}\right)^2 = 0.000310$
	200'-6 54" Sp.			$\%\,X_{react.}$ = per cent reactor reactance		X Primary (total) = 0.011742
	3-100 KVA 4800/480 % IX = 1.99	Regulators	For 3φ regulators: $\left(\frac{\%\,X_{reg.} \times 10 \times KV._{rated}}{\sqrt{3}\, I_{reg.}} \times \frac{(KV.)^2}{(KV_{op})^2}\right)$ For 1φ regulators: $\left(\frac{\%\,X_{reg.} \times 10 \times KV._{rated}}{I_{reg.}} \times \frac{(KV.)^2}{(KV_{op})^2}\right)$	$I_{react.}$ = rated reactor current		X Transf. = $\frac{1.99 \times 10 \times 4.8^2}{300} \times \left(\frac{0.48}{4.8}\right)^2 = 0.015280$
				$\%\,X_{reg.}$ = percent regulator reactance		X Secondary = $\frac{400}{5280} \times 0.630 = 0.047700$
				Use 1 for 10 % regulators Use 0.25 for 5% regulators		$= \frac{175}{5280} \times 0.581 = 0.019260$
	400'-4/0 34" Sp.	Overhead lines	$X_L \times \frac{(KV.)^2}{(KV_{op})^2}$	$I_{reg.}$ = rated regulator current		X Secondary (total) = 0.066960
				X_L = total line reactance		X Capacitor = $\frac{100 \times 10 \times 0.46^2}{60} = 3.53$
	175'-1/0 34" to 7" Sp.	Transformers	$\frac{\%\,X_{trf.} \times 10 \times \overline{KV.}^2_{rated}}{3\phi\ KVA_{trf.}} \times \frac{(KV.)^2}{(KV_{op})^2}$	$3\phi\ KVA_{trf.}$ = rated transformer bank 3φ output		I Cap. = $\frac{480}{\sqrt{3}} \times \frac{1}{3.53} = 78.5$ A
Load	Proposed 60-KVA. 460 volt capacitors			$\%\,X_{trf}$ = percent transformer reactance		
		Capacitors	$\frac{1000 \times \overline{KV.}^2_{rated}}{KVA_{cap}} \times \frac{(KV.)^2}{(KV_{op})^2}$	$KVA_{cap.}$ = rated capacitor output		

Total reactances - (480-V. base)

System to secondary of transf. bank	= 0.030484 ohms
System to capacitor	= 0.097444 ohms
Transformer and secondary only	= 0.082240 ohms
Primary to capacitor	= 0.093982 ohms

less than 600 cycles, it is recommended that enough capacitors be automatically disconnected at light load to raise the calculated resonant frequency to 600 cycles or more.

Switched-off Capacitors

Two conditions limit the application of secondary capacitors; voltage rise, as calculated in Part I, and resonant frequency. The maximum amount of capacity that may be permanently connected to the secondary bus is taken as the lower of these two limiting kva. conditions.

In the example case set up in Part I of this article:

$$X_L = 0.08224 \text{ and } L = \frac{0.08224}{2\pi 60}$$

$$X_C = 3.53 \text{ and } C = \frac{1}{2\pi 60 \times 3.53}$$

$$f_r = \frac{1}{2\pi\sqrt{\frac{0.08224}{2\pi 60} \times \frac{1}{2\pi 60 \times 3.53}}} = \frac{60}{\sqrt{\frac{0.08224}{3.53}}} = 394 \text{ cycles}$$

Since this frequency is below 600 cycles, the kva. to be permanently connected must be reduced.

Solving for X_c using a maximum f_r of 600 cycles:

$$600 = \frac{60}{\sqrt{\frac{0.08224}{X_c}}}$$

and $X_C = 100 \times 0.08224 = 8.224$ ohms

Therefore, the maximum kva. of capacitors that may be connected permanently to the secondary bus for a resonant point above 600 cycles

$$KVA_{cap} = \frac{100 \times 10 \times 0.460^2}{8.224} = 25.7$$

(using equivalent circuit formula of Part I)

Hence, no more than 25 kva. of capacitors may be connected permanently to the secondary bus, as far as resonant conditions are concerned. (It was proposed in the example problem to install 60 kva. of 460 v. capacitors.)

Voltage Rise

Testing to find the voltage rise due to this additional capacity which may be permanently connected to the secondary bus, we have:

$$X_C = \frac{100 \times 10 \times 0.460^2}{25} = 8.46 \text{ ohms}$$

$$I_{cap} = \frac{480}{\sqrt{3}} \times \frac{1}{8.46} = 32.8 \text{ amperes}$$

On the basis of 25 kva. of capacitors permanently connected to the customer's secondary bus, the voltage rise is:

$VR = \sqrt{3} \times 32.8 \times 0.0940 = 5.3$ volts on 480-volt base.

The maximum voltage on the customer's secondary, therefore, will be increased by 5.3 volts at both light and full load. This voltage must be less than 529 volts, the maximum capacitor voltage permitted by the manufacturers rating.

In the example case, the maximum kva. of capacitors which may be permanently connected to the secondary is restricted by the resonant frequency limitations rather than voltage limitations to the above calculated 25 kva.

Where the transformer bank serving the customer consists of an open-delta or open-wye step-down arrangement, or when capacitors are installed at two or more locations on the customer's secondary circuit, additional branches must be added to the original equivalent or model circuit. Such circuits may be solved for the resonant frequency by an extension of the method used above, but the solution is long and complicated. A short, simple solution utilizing "operational" methods is outlined in the following paragraphs.

Two-branch Cases

The great majority of "two branch" cases of industrial capacitor installation fall into one of two groups.

1. Capacitors connected to the secondary side of an open-delta or open-wye transformer bank, Fig. 1 (a). For calculation, this connection may be represented by its mathematical equivalent shown in Fig. 1 (b).

For the above circuit one may consider any branch to be in series with the other two branches in parallel, and a short circuit placed on the high side of the customer's transformer banks.

The quantity "P" as used in the following equations represents the numerical ratio between the resonant frequency and the power supply frequency. All following values of V are calculated on a line to neutral basis as previously.

Using $X_1 = 3\ X_{trf} + X_{sec}$

$$X_1P + \frac{X_c}{P} + \frac{\left(X_1P + \frac{X_c}{P}\right)\left(X_{sec}P + \frac{X_c}{P}\right)}{X_1P + \frac{X}{P} + X_{sec}P + \frac{X_c}{P}} = 0$$

or $\left(X_1P + \frac{X_c}{P}\right)\left(X_1P + X_{sec}P + \frac{2X_c}{P} + X_{sec}P + \frac{X_c}{P}\right) = 0$

$$\left(X_1P + \frac{X_c}{P}\right)\left(X_1P + 2X_{sec}P + \frac{3X_c}{P}\right) = 0$$

Solving for "P" in the above formula reduces to the solution of a simple quadratic. Two possible resonant frequencies are derived from the positive values of "P" by

$$F = \frac{60}{\sqrt{-1}} \text{ multiplied by "}P\text{".}$$

2. Capacitor banks connected to each of two secondary branches.

A similar type of circuit to the above involves secondary capacitors added to branch circuits served from the secondary bus of a step-down bank. The equivalent line-to-neutral circuit of such a system is similar to Fig. 1 (a).

Let $X_{trf} + X_{sec} = X$

$$XP + \frac{\left(X_1P + \frac{X_{1c}}{P}\right)\left(X_2P + \frac{X_{2c}}{P}\right)}{X_1P + \frac{X_{1c}}{P} + X_2P + \frac{X_{2c}}{P}} = 0$$

Again this resolves into the solution of a simple quadratic, and the two positive values of resonant frequency are derived from the values of "P" by:

$$F = \frac{60}{\sqrt{-1}} \text{ multiplied by "}P\text{"}$$

Still more complicated circuits may be encountered which can be solved by similar methods but the far greater number of cases may be represented by the two simple types of circuits just described.

In concluding this discussion of mathematical tests applied to proposed capacitor installations, we must remind ourselves that careful calculations are as accurate, no more and no less, than the data on which they are based. When made from carefully collected and verified data, these tests provide a valuable guide to trouble-free installations of industrial capacitors.

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Reversed Titles

In the article "Locating Trouble on 3-phase Ungrounded Secondaries," by A. B. Jones of the Boston Edison Co., in ELECTRICAL WORLD, December 23, 1944, page 63, the caption printed with Fig. 3 should be transferred to Fig. 4 and vice-versa.

←——FIG. 2—Equivalent circuit calculations for simple capacitor problem

Editorials

S. B. WILLIAMS, *Editor*

Presented, A Report

PROBABLY not many people in the electric utility industry, except a few engineers and others directly concerned, know anything at all about the Utilities Wartime Aid Program. It's a safe bet, certainly, that the general public, including most power company employees, know nothing about it.

This week a report on the operations and accomplishments of the Program was presented to the Army and the Navy. Accepting the report for their respective services from its national coordinator, Dan A. Sullivan, General Reybold and Admiral Moreell acknowledged the great help of the utilities in providing and maintaining electric service in camps, yards and fields where the sinews of war in men and material were, and are still being, gathered together.

The report, detailing the close cooperation of utility engineers and construction and operating men with Army and Navy officers responsible for electricity supply in military installations, is an inspiring document. It should make every utility employee feel proud of the industry of which he or she is a part, an industry that in addition to assuring that its service to the nation was and is always "enough and on time" also gave and is still giving openhandedly of its special skills and abilities to help the armed forces in their big job of transforming our peaceful country into a fighting nation.

Harmonic Energy Errors

WAVE FORMS in general are so much better than they used to be that there is less occasion than there might well have been in earlier days for worrying about the effect of harmonics upon watthour meter accuracy. But the third harmonic that seems inherently coupled with the magnetization cycle of iron is always on the point of manifesting itself and those harmonics that accompany arc rectification are likely to be on the ascendancy. In short, there is reasonable justification in asking right now —what errors in registration occur when a watthour meter designed for a 60-cycle service of commercially sinusoidal contour is subjected to voltage and current alternations that are distorted by harmonics?

Fortunately they are not serious for likely conditions. It is said that the error is usually less than one percent for a peaked wave that embraces as much as 30-percent of the triple and up to 8 percent of other odd multiples. The tendency is to overregister on the lagging-current loads when the wave is peaked and underregister when the phase position of the harmonic is shifted to give a flat top. Conversely at unity power factor, the registration appears to be higher for flat top shapes than for the peaked waves.

There are so many possible variables in (1) percentage of particular harmonics, (2) their relative phase positions, (3) presence or absence in either the current or voltage that no general statement can be made except that, if a limit of one percent can be rated as not bad, the performance of watthour meters on warped 60-cycle wave forms is remarkably good.

What would happen if the wave were all harmonic and no 60-cycle is a moot question. But in view of the growing resort to 400 cycles for aviation, 3,500 to 10,000 and even up toward 50,000 and 100,000 cycles for induction heating it is not going to be long before there will be call for a watthour meter of simple pattern to register such consumptions accurately. It will be interesting to see what emerges.

The Challenge of Distribution

DISTRIBUTION ENGINEERING remains as one of the most intriguing and commanding problems facing utility engineers after the war. It continues to absorb the largest part of the capital commitment per customer and therefore offers the most alluring opportunity for investment economies that can be reflected in further rate reductions and consequent increase in kw.-hr. utilization. At the same time it represents greater diffusion, diversification and adaptation to environment than any other part of a physical utility system. Distribution seems to defy unified attack and it also encourages day-to-day expediency methods in rendering it capable of the ever-changing demands on it.

Time is ripe for a new concerted analysis of distribution. In some quarters it is being studied assiduously and the articles which have been published show the gains made. But it merits the intelligent and critical attention of every system from the smallest cooperative or municipal to the largest metropolitan-area utility.

Fortunately, the very diversification which is characteristic of distribution presents the very multiplicity of facets for penetration of the problem. How much can a higher primary voltage be warranted as helpful? Should more of the area be converted to a form of network? Is there not a real gain in secondary banking at more points? What is the optimum size and spacing of transformers and

of substations? How much should go underground now and how much be deferred? Are self-supporting and buried cable feasible tools? What about rear lot-line service and kiosks for the transformers? Is streamlining of the pole-top something with dollar value as well as esthetic? Are there significant savings in standardization of design and of hardware?

Disjointed answers have been found here and there for each one of these component problems but who has put them into a mosaic with appropriately weighted values? Who likewise has evaluated the worth of an avoided interruption and is prepared to apply a protective scheme that assures continuity comparable with what has been established for transmission?

Any answers found for these constituents of the problem must be such as to fit the loads that post-war promotions will bring and not merely today's load. Is enough known about the benefits that can come from cultivating loads that will have favorable diversity? Maybe the voltage regulation technique could afford significant savings if more spread could be tolerated without endangering the performance of utilization equipment.

Distribution has been a challenge to the utility engineer for years. The engineer who solves it for the coming loads will probably be the one who can detach himself from the details of hampering precedents and synthesize the solution for his system, taking account of what he now has and what he will be facing as to future loads.

Servicing Heavy Duty Appliances

BEFORE the temporary setback of the Allies in Europe deflected much thinking from post-war planning, a good deal of consideration was being given to future servicing of heavy duty appliances. Market surveys by power sales engineers covering counter stands have revealed the need of more systematic servicing facilities, and in some installations embodying large electric ranges it is apparent that such business, to stay sold, calls for highly concentrated service responsibilities. In other words, 'Old Man Competition" is not asleep for the duration, but is active and alert to take advantage of restricting war conditions that affect the making and maintenance of electrical equipment. The gas companies are making the most of their opportunity.

There is a growing sense of the importance of establishing responsibilities and qualifications for maintaining heavy commercial equipment on central station lines. The time appears ripe for establishing principles under which the several branches of the industry can best cooperate locally in relation to servicing. Post-war competition bids fair to be acute, even within our own industry; but just as merchandising on a basis of fair prices promises to benefit all participating dealers, so provision for first-class maintenance of these important appliances means stabilization of servicing and the growth of markets for such equipment and for electrical energy. Such servicing means frequent and regular contacts with customers, plus responsible facilities for the immediate delivery and installation of needed parts in case of trouble. Such facilities and organizations may be difficult to maintain under present war conditions in many areas, but when hostilities draw to a close, they must not be found wanting if local electrical industry branches are to meet their obligations to each other and to the public.

Cable Prophylaxis

BECAUSE cable engineering is heavily weighted with unknown quantities the conclusion is sometimes voiced that it is a well-nigh hopeless task to attempt to predict either life expectancy or the onset of service failures for a given installation. There are admitted limitations to current test practices taken individually, and doubtless much to be desired in the interpretation of grouped data taken from field measurements. But such limitations are not necessarily permanent.

Assuming that the design, material composition and manufacture of a cable represent high quality engineering and production supervision, it is probably too much to expect such uniformity in finished mileage lengths as would satisfy perfectionists. Such work is far less simple than might appear to an outsider observing the mass production of cable in the modern factory. But it is safe to say that standards of achieved quality are in general high enough today to establish a foundation upon which to build a sound structure of engineering tests revealing the characteristics of installed cables in reference to service reliability and durability on particular systems of distribution.

Such studies must take account of dielectric strength, a most useful index of condition; power-factor status against time-heating values; dielectric losses; local conditions, including operating records and surge information; presence of moisture, manhole, pothead and joint performance. The number of variables is large and baffling, as is the frequent destruction of evidence which might throw light upon causes and remedies of cable failures.

The fact remains, however, that knowledge rests upon the patient cultivation of test methods, material and field analyses, plus the pooled judgment of manufacturers and users. We may not be able as yet to predict cable life and failures satisfactorily in many specific installations, but trends can be indicated to guide designer and operator. These trends are bound to be more and more useful in pointing the way toward the removal of suspected cable and fittings from important service (as to war plants), their repair or replacement. In a way the present situation as to cable bears some resemblance to that of oil circuit breakers and bushings a decade or so ago, since which time great advances have been made in reducing obscure and elusive factors to better order and control.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Relief from Pressure of War Is Not Likely Soon

War production planning in the United States is now based on the proposition that both the European and Pacific wars will last indefinitely. It is further adjusted to an eventuality the nation's top military leaders had hoped to avoid—the waging of major offensive wars in Europe and the Pacific simultaneously.

For electric utilities, this means that the day when manpower and fuel stringencies will be things of the past, when large-scale rehabilitation and expansion of plant will be possible and when replacement of war with peace-time loads will become a problem, is hardly around the corner. An indirect effect of the revised war production program is a dim prospect of broad tax relief.

Military leaders had hoped that the European war would be won by the time we were in position to throw our real might at the Japs. That they expected this would be so can be demonstrated by their monthly revision downward of production requirements from January, 1944, through last September. The precipitous boosts of the production program which have been ordered since last October testify to the drastic nature of the war production revisions which have been made.

War Demands Pile Up

The fact that we got ahead of ourselves in the Pacific while we fell behind our hopes in Europe will have a profound effect on the war production after Germany is defeated. Where last summer the expectation was that V-E Day would be followed by a cutback of perhaps 40 percent in war production, the realization of a major war in the Pacific ahead of schedule has halved this anticipated cutback. If the Germans hold out in Europe beyond the V-E Day date which is now rather gingerly muttered behind the hand in Washington—a wholly inconclusive "summer of 1945"—the whole program will have to be stepped up.

Already the heavy artillery ammunition program, which was doubled and re-doubled so many times last year that all but the statisticians have lost count, has undergone its first major expansion of 1945—an expansion over and above that astronomic level of which we were falling so far short late last year. The new facilities won't be in before September. Likewise, the high-octane gasoline program is due to be boosted on a major scale to feed the swarms of Super-Fortresses whose production is gaining steadily. These new gasoline plants won't be in until mid-1946. Both expansion programs, along with several others ordered late last year, come at a time when, it was firmly believed a year ago, our war construction was to be almost negligible.

Complicated by New Productions

The downward revision of war production estimates through the first nine months of 1944 cut the total 1945 program from 66 billions to 56.6 billions. Since October, the total has been boosted back to 64.6 billions, or just about the size of 1944's output. If the items scheduled for this year were the same as those manufactured last year, this would provide little trouble, for the production lines would be in operation and running smoothly. Output per man-hour would be rising steadily, affording a cushion against deterioration of the labor force. Cutbacks and other forms of contract termination would not have dispersed production organizations with the consequent disappearance of workers from the labor market.

Actually, the 1945 output cannot be achieved so easily. About 55 percent of the 1945 programs are rising in volume while about 35 percent are dropping. Thus, new production lines are opening, demanding new workers, while others are closing or slowing down. Efficient transfer of workers from de-emphasized programs to jobs in urgent new programs is a problem which has not yet been completely solved, involving as it does the geographical transfer of labor, the acquisition of new skills, the desire of workers who would not usually be employed to return to normal life, or the desire of other workers to obtain employment secure in peacetime. The change in weapons adds further to production difficulties. A year ago, for instance, the use of rockets was largely experimental. This year the Navy alone wants a rocket program of $100,000,000 a month, and there is no guarantee it will not rise higher. These factors, of course, are not insurmountable obstacles, but they will render the job more difficult.

Manpower the Major Problem

The services now plan to take 900,000 men by July 1, and there probably is more chance that this figure will be increased than that it will be lowered. War and essential civilian industries need 700,000 additional workers as soon as they may be had. Obviously, neither of these demands is going to be filled with the snap of the finger which would have sufficed in earlier days. A year back, labor shortages were approached by squeezing non-essential civilian occupations. This year, the squeeze will be on the less-essential civilian pursuits, and could easily extend upward into occupations hitherto considered almost draft-proof. Of course, the number of men to be drained from more-essential jobs in critical industries will depend on the number available for less-essential jobs in industries designated as less-essential, essential and critical. The more-essential men in critical industries will be the last to go, but unless War Mobilizer Byrnes was talking purely for the fun of it when he propounded his recent five-stage induction schedule (ELECTRICAL WORLD, January 20, page 124); more-essential employes of electric utilities will be inducted when they are needed and if no one else is available, even though utilities are classified as critical industries.

NEWS OF THE WEEK

Supreme Court Upholds SEC on Asset Liquidation

Supports Order Splitting Assets of Liquidated United Light & Power Co. Between Preferred and Common Stockholders Despite Inability of Company to Meet All Obligations Outstanding against Preferred Stock

The Supreme Court this week upheld the Securities and Exchange Commission's contention that liquidation of a holding company under Section 11 (b) (2) of the Public Utility Holding Company Act of 1935 need not mature securities of the affected company.

By a 5-3 decision in which Mr. Justice Douglas did not participate, the high court upheld a ruling of the Third Circuit Court of Appeals which validated an SEC order splitting assets of the liquidated United Light & Power Co. on a 94.52-5.48 basis between preferred and common stockholders respectively, despite the fact that assets of U. P. & L. are insufficient to meet all obligations outstanding against the preferred stock if it be considered matured.

The case went to the Supreme Court on certiorari granted Otis & Co., Cleveland investment bankers, which insisted that the division was improper in view of U. L. & P. charter provisions calling for payment of $100 per share and accumulated dividends to preferred stockholders upon dissolution.

Chief Justice Harlan F. Stone delivered the dissenting opinion in which Mr. Justice Roberts and Mr. Justice Frankfurter concurred.

The dissolution plan was based on the contention that if the utility operations on which U. L. & P.'s hope of income was ultimately based were to continue, an estimate of anticipated earnings over the next 15 years would indicate that the full value of the preferred stock, plus accumulated dividends could be paid off, enabling common stockholders thereafter to share in the earnings.

Pointing out that SEC could have fulfilled requirements of the act other than by dissolving U. L. & P. Mr. Justice Reed, who delivered the majority opinion, held that SEC's exercise of statutory power "in a type of liquidation which is entirely distinct from the 'liquidation of the corporation, whether voluntary or involuntary' envisioned by the charter provisions of U. L. & P. for preferences to the senior stock," adding that:

". . . Congress did not intend that (SEC's) exercise of power to simplify should mature rights, created without regard to the possibility of simplification of system structure, which otherwise would only arise by voluntary action of stockholders or, involuntarily, through action of creditors."

"When the Commission proceeds in the simplification of a holding company system," Mr. Justice Reed asserted, "the rights of stockholders of a solvent company which is ordered by the Commission to distribute its assets among its stockholders may be evaluated on the basis of a going business and not as though a liquidation were taking place."

The majority opinion discarded the petitioner's contention that the "Absolute Priority Rule," which holds no plan of asset distribution is fair and equitable unless obligations to senior securities are met in full before junior issues get anything, should prevail in this case, holding rather that the issue is whether charter provisions should be considered to apply, declaring:

"We think . . . the charter preference is inoperative in simplification under Section 11 (b) (2). The provision having been adopted in 1929, six years prior to the enactment of the Holding Company Act, a 'simplification' under this act, having as an incident to it the dissolution of one company in a holding company system, was not an anticipated 'liquidation' within the meaning of U. L. & P.'s charter. Enforcement of an overriding public policy should not have its effect visited on one class with a corresponding windfall to another class of security holders. Nor should common stock values be made to depend on whether the commission . . . resorts to dissolution of a particular company or resorts instead to the devices of merger and consolidation which would not run afoul of a charter provision formulated years before . . . the Commission . . . should not be hampered . . . by considerations of avoidance of harsh effects on various stock interests which might result from enforcement of charter provisions of doubtful applicability. We do not feel constrained to hold that where liquidation is adopted as a matter of administrative routine, the preferences are thereby matured."

Constitutionality Not Considered

The opinion pointed out that "we have not considered in any way the constitutionality of the sections of the Holding Company Act involved."

In his dissent, Mr. Chief Justice Stone referred to the "almost clairvoyant precipience" of SEC in prophesying that the company would, in 15 years of continued operation, pay all preferred obligations adding:

"The judgment of the court below sustaining so extraordinary a result should be reversed because the commission, without authority in law and contrary to the command of the statute, has disregarded the plain terms of the corporate charter controlling priority of the preferred stock upon liquidation of the company whether voluntary or involuntary."

The lower court, Stone argued, based its decision on the ground that the charter preference provisions are inapplicable to a liquidation like the one at issue. The commission, he went on, based its contention on the "Fair and Equitable" Clause of the act, holding

that if the charter provisions do apply, SEC is free to override them to achieve fairness and equality.

Holding it plain that U. L. & P. is being liquidated and that all preferred obligations are not met before junior issues get anything, Mr. Justice Stone said of the lower court's contention:

"Unless words have lost their meaning, the stipulation for priority in this case cannot fairly be taken not to include any kind of liquidation which would compel the surrender of the stockholder's investment and force him to sever his connection with the corporation in which he has invested . . . to conclude that the present stipulation for priority upon involuntary liquidation did not envisage a liquidation such as this one seems like saying that an insurance policy payable on the death of the insured creates no obligation if the insured dies from a disease which was unknown when the policy was written."

Of the commission's assertion of authority to override charter preferences to achieve fairness and equality, the dissent said:

"Such provisions for priority constitute a contract which is entitled to constitutional protection, impairment of which is not lightly to be attributed to Congress. We find no provision of the statute which proports to confer upon the commission any authority to set aside a lawful stipulation in which the stockholders have joined fixing their relative rights in the event of liquidation."

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Insurance Company Buys East Oregon Light Bonds

The entire $1,800,000 issue of 3½ percent refunding mortgage bonds of Eastern Oregon Light & Power Co. has been purchased by a life insurance company of Milwaukee, Wis., President LeRoy Grettum has revealed. The new bonds represent the entire indebtedness of the company and will mature over a 25-year period. The old bonds bore 5½ percent interest.

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Missouri Co-op Ordered to Reduce Minimum Rate

Because the revenues of the Sho-Me Power Cooperative,, Inc., are sufficient to meet operating expenses and fixed charges and to provide a surplus enabling it to meet all obligations and retire its present indebtedness, the Missouri Public Service Commission has ordered it to reduce its minimum charge per customer from $1.25 to $1 monthly, effective January 1.

Service Chiefs Given Report on Utility Aid

Dan Sullivan, Coordinator of Utilities Wartime Aid Program, Makes Presentation at Washington

Chiefs of the Army's Engineer Corps and the Navy's Bureau of Yards and Docks expressed their gratification this week at the results of the Utilities Wartime Aid Program which for more than three years has been helping the services handle electric power problems at domestic installations and supplying trained power engineers for sea and foreign duty.

National Coordinator Dan Sullivan presented reports on the program to Maj. Gen. Eugene Reybold, chief of engineers, and Vice-Admiral Ben Moreell, Chief of the Bureau of Yards and Docks, at Washington this week. Both officers told Sullivan they were "very glad" to receive the report on the program, which Admiral Moreell described as "another example of the Navy's desire to cooperate with American industry."

Sullivan in turn thanked the two officers for help their organizations had been to electric companies in times of natural disasters. Service personnel, Sullivan said, helped immeasurably in the hurricane flood on the Missouri River in the spring of 1943.

Gen. Reybold asserted that the program had a "fine set-up" which was "a great help to us." Admiral Moreell declared that it helped the Navy to operate its stations more efficiently and with less critical materials.

The report put in print the ways in which the utilities have aided the government during the war. In addition to such non-technical aid as cooperating in war bond and recruiting drives, the industry aided the services by lending equipment and tools, by supplying key men and trained personnel, by furnishing advice on technical problems at service installations, by setting up training programs for men in the services, and by repairing at cost equipment being used by the services.

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Portland General Electric Lease Sold to Paper Co.

Purchase of three leases from Portland General Electric Co. to Crown-Zellerbach Corp. has been made by Hawley Pulp & Paper Co. of Oregon City, Ore., it was announced recently by Hawley president, John H. Smith, as part of a deal whereby Hawley acquired all leases of Crown east of the Willamette River.

Lease transfers divest Crown of all interest in property rented from P.G.E. east of the center line of the Willamette, principally affecting a steam power plant, Mill H, the Hawley sawmill and some grinders. Leases involve use of land, water rights and machinery installed at the lower end of the dam at Willamette River Falls, for many years a source of power at Oregon City.

Rights of Crown in a June, 1920, lease from P.G.E. for water, to generate 2172 horsepower are protected in the agreement, however.

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Edison Institute Signs Ayer's to Aid Publicity

N. W. Ayer & Son, advertising agency, has been retained by Edison Electric Institute as publicity advisers. The agreement, which was made after a mail vote of the board of directors, is for an indefinite period.

The advertising firm will assign one man full time, placing the entire resources of the organization at his disposal, to serve the institute. He will work with editors and writers of national news syndicates and magazines to interest them in, and assist them in gathering material for, articles which they will write themselves about the accomplishments of the private utility system, or about the many problems of public interest which are connected with utility ownership and operation. Agency writers will also prepare similar stories for placement with national news services and magazines.

C. W. Kellogg, president of the institute, in announcing the agreement said, "One of the functions of the institute, according to its constitution, is the gathering and dissemination of factual data about the electric light and power industry and this employment is in furtherance of that function. It will supplement the work the institute has always done in making available to the general public the information it collects concerning the industry."

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Pennsylvania Electric Co. Purchases Site for Plant

Pennsylvania Electric Co. has purchased 100 acres of land along the Allegheny River, west of Warren, as the site for a $4,000,000 coal-burning generating plant with 30,000-kw. capacity to handle post-war requirements of the Warren-Bradford area.

Pacific Coast Heads List of Brownout Exemptions

OWU Denies Numerous Applications Because of Interconnections or Use of Scarce Fuel—U-9 Modified to Allow Public Lodging Houses One Light over Each Entrance—Exemptions Expire June 30 Unless Renewed

A chain of states ranging from Canada to the Gulf of Mexico was exempted from compliance with the otherwise nationwide brownout this week by the Office of War Utilities which found, with only rare exceptions, that the mandatory curtailment which went into effect this week would not effect significant fuel savings there.

Along the Pacific Coast, only San Diego and Catalina Island will be required to darken outdoor commercial lighting under Order U-9, while Montana, Idaho, Utah, Washington, Oregon, the remainder of California, most of Nevada, Arizona, New Mexico and Texas and much of Louisiana will be exempt, the first five states because of flush hydro supplies which cannot be exported for displacement of fuel elsewhere, the remainder principally because of flush supplies of natural gas, which is not a scarce fuel in the southwest or California, or because of extensive hydro capacity.

A limited area in upstate New York also was exempted because of hydro capacity which could not be exported, along with two small hydro systems in upper Michigan and a tiny system in West Virginia which uses hog fuel.

Exemptions Expire June 30

All exemptions expire next June 30 unless renewed. OWU Director Edward Falck announced that exempted systems would have to file applications for continuance of the exemption by May 15, reporting pertinent data including water resources, load increases and the like. He said it is possible that some changes in the exemption list may be made after June 30, when present exemptions expire.

Numerous applications for exemption were flatly refused by the Office of War Utilities which cited interconnections or use of scarce fuel in savable quantities.

Having thus disposed of the principal problems confronting his U-9 organization, OWU Director Edward Falck told a press conference this week on the eve of the effective date of U-9 that enforcement would start from February 1 on a strict basis.

Meanwhile, OWU announced the first modification of Order U-9 when it instituted Direction I to the order, under which hotels and other public lodging places may light one directional or identification sign of not more than 60 watts over each entrance.

Exemptions granted by OWU were as follows:

Pacific Northwest

Oregon, Washington, Montana, Idaho and Utah as an area without exception, under paragraph (d) (2) of order U-9 which allows OWU to grant area exemptions. Not every supplier in the area appealed. It was found that in this area, all energy is hydro except for spinning reserve which, even though it uses a scarce fuel, is unsavable, and curtailment of lighting served by this spinning reserve would not save any fuel. While it was conceded that certain small "island" systems in the area use scarce fuels (diesels and gas-fired plants) their generation totaled substantially less than 1 percent of the area total. In these cases, curtailment would have effected only negligible savings and would have darkened a few communities in an undarkened area.

California

All the state is exempted except that area served by the San Diego Gas & Electric Co. and Catalina Island, lying off Los Angeles. San Diego uses fuel oil in appreciable quantities, and Catalina Island is served by a diesel system which also uses oil. The remainder of the state is served by natural gas and hydro capacity and is self-contained pool, along with portions of Arizona and Nevada, from which export is not feasible.

Nevada

Exemptions, which cover most of the state's population, include the counties of Washoe, Humboldt, Pershing, Churchill, Storey, Douglas, Ormsby, Mineral, Esmeralda, Nye, Lincoln, Lyon, Clark and that portion of Elko County receiving service directly or indirectly from the Idaho Power Co. Exemption was based on interconnection with the West Coast pool.

Arizona

Exemptions, which cover most of the state's population, include the counties of Mohave, Yuma, Santa Cruz, Coconino, Yavapai, Maricopa, Gila, Pinal and Pima, which have hydro capacity and are interconnected with the West Coast.

Louisiana

Exempted because of generation with hydro and natural gas, which is not scarce in Louisiana, was an area including the following parishes: Calcasien, Cameron, Jefferson Davis, Acadia, Vermillion, Lafayette, St. Martin, Iberville, Iberia, St. Mary, Terrebonne, Plaquemines, St. Bernard, Orleans, St. Charles, Assumption, East and West Baton Rouge, St. John the Baptist, East and West Feliciana, St. James, Ascension, Livingston, Point Coupee and

THE SAMUEL B. WILLIAMS CLASS—In honor of the national president of the Illuminating Engineering Society, who is touring the country in the interests of the society, the Los Angeles section named a group of 15 new members for him and presented him with a Mexican tapestry shawl and sombrero. Mr. Williams, in front row wearing the shawl and sombrero, is making the tour to enlist the support of the illuminating engineering profession in his drive to re-light America

those parts of adjacent parishes whose only energy is transmitted from the Gulf States Utilities System.

Also exempted was the city of Monroe, which is served by a municipal hydro system. The remainder of the state is under the order.

Texas

The entire state was exempt except all or parts of 18 eastern counties served by the Southwestern Gas & Electric Co., of Shreveport, La., and those systems served by Southwestern at wholesale. Exemption, granted under paragraph (d) (2) of U-9, was based on the fact that energy is either hydro or gas-fired, with natural gas considered not a scarce fuel in Texas. Despite the existence of a number of "island" systems using oil, their output was insignificant compared to the total, again less than 1 percent.

New York State

Exemptions were limited to portions of three upstate counties served by the Plattsburg municipal system, the Paul Smith Electric Light, Power & Railroad Co., Saranac Lake, N. Y., and an isolated section of the New York State Electric & Gas Corp. system. All are served by hydro energy except the New York State Electric & Gas pocket where savings would have been trifling and could not have been used if realized since energy moves into the area only on peak. Exemption was granted under paragraph (d) (2) of the order.

New Mexico

Exemptions were limited to three sections of the state, covering most consumers, the sections being:

1. That area served by the Albuquerque Gas & Electric Co. and the Santa Fe division of the New Mexico Power Co., where generation is gas-fired. Natural gas is not considered a scarce fuel in New Mexico.

2. That area served by the El Paso Electric Co., the Reclamation Bureau's Elephant Butte project, the Lordsburg and Silver City divisions of the Community Public Service Co., Fort Worth, Tex., and the Deming Ice & Electric Co., of Deming, N. M. Generation in this area is by hydro and gas-fired steam.

3. That area served by the Southwestern Public Service Co., which is interconnected with the Texas system, including portions of the counties of Curry, Roosevelt, Chavey, and Eddy.

Additional exemptions included the Hillman Light & Power Co. of Alpena, Mich., and the Copper District Power Co., Ontonagon, Mich., both isolated hydro systems, and the Meadow River Lumber Co., Rainelle, W. Va., which generates with hog fuel. Lamar and Pagosa Springs, Colo., and the Houghton County Electric Light Co. in northern Michigan.

Appeals by the Southwestern Gas & Electric Co., Shreveport, La., and the Oklahoma Gas & Electric Co., of Oklahoma City, were denied on the basis that each used scarce fuels, either coal or oil, and that they are interconnected with Arkansas and the East, with savings realizable by displacement. Other denials include:

Hominy, Ponca City and Cushing City, Okla., which use scarce fuels; Murray, Ky., electric plant board, interconnected with TVA; Public Electric Light Co., St. Albans, Vt., interconnected with New England Power Co.; Woodstock (Va.) Electric Light & Power Co., uses diesel oil; Edenton, N. C., Light & Water Department, interconnected with Virginia Electric & Power Co.; Burlington (Vt.) Electric Light Department, and Morrisville (Vt.) Water & Light Department, both interconnected with New England Power Co.; Grundy Center (Ia.) Municipal Light & Power Department, interconnected with Iowa Electric Light & Power Co.; Morristown (Tenn.) Water & Electric Light Plant, interconnected with TVA; Top O'Michigan Rural Electric Co., Boyne City, Mich., interconnected with Michigan Public Service Co.; Oswegatchie Light & Power Co., Gouverneur, N. Y., interconnected with Central New York Power Corp., Lawrence Park Heat, Light & Power Co., Bronxville, N. Y., uses scarce fuel; Wadhams and Westport Power & Light Corp., Wadhams, N. Y., interconnected with New York Power & Light Corp.; Montezuma (Ia.) municipal plant, uses scarce fuel.

The following denials were based on use of scarce fuel or interconnection: Fosston (Minn.) Municipal Light & Power Co.; Fairbury, Neb., municipal; City Water & Light Co., Hastings, Neb.; McPherson (Kan.) Water & Electric Department; Wyodak Coal & Manufacturing Co., Gillette, Wyo.; Public Utility Commission, Clay Center, Kan.; Raton Public Service Co., Raton, N. M.; H. P. Gould, Lyons Falls, N. Y.; City of St. John, Kan.; Consumers Public Power District, Columbus, Neb.; and Meade (Kan.) Municipal Light & Water Department.

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Utility Gets Franchises

Iowa Public Service Co. won two franchise elections in December by votes that were almost unanimous. Oyens, Ia., voted a 25-year franchise, 40 to 1. and Merrill, Ia., approved a 20-year franchise, 125 to 1.

Rivers and Harbors Bill Passes Senate

291 Projects Included in Bill from Which All Controversial Items Have Been Eliminated

The Senate passed and sent to the House this week a non-controversial Rivers and Harbors Bill containing 291 projects whose cost is estimated at $381,968,332, including seven power projects.

The bill went through the Senate without discussion after Senator John Overton, Louisiana Democrat and Chairman of the Commerce subcommittee which considered the bill, reported that all controversial projects had been eliminated, and that it contained only projects which had already been approved by both houses but which failed of enactment because of the floor fight over the Elliott rider late in the last session. The Senate heard a letter from Rep. Joseph Mansfield, Texas Democrat and chairman of the House Rivers and Harbors committee, which predicted that no opposition would be raised in the House.

Sponsors of controversial amendments agreed to withhold their projects and let the bill pass. It provides no appropriations and forbids any construction until six-months post-war.

Among the controversial projects left out of the bill are the Tennessee-Tombigbee waterway, the Beaver-Mahoning Canal and the Santee-Congaree navigation and power project in North and South Carolina which were deferred to afford local residents an opportunity to be heard.

Overton announced that another Rivers and Harbors Bill would be introduced later this session, to include not only projects that were reported on by the Army Engineers up to that time but also the controversial projects which were kept out of the present bill.

Power projects in the bill sent to the House this week include: Apalachicola, Chattahoochee and Flint Rivers in Georgia and Florida; Alabama-Coosa River in Alabama; Neches and Angelina Rivers in Texas; Guadalupe River in Texas; St. Mary's River in Michigan, where the present powerhouse would be junked and replaced with another of 14,000 kw., output to be marketed by the Engineers; Snake River in Oregon, Washington and Idaho, the project consisting of enough dams to provide slack water for navigation; and Umatilla Dam on the Columbia near Bonneville Dam. Determination of ultimate generating capacities of these projects has not been made.

FPC-State Board Battle Taken to Federal Court

Arkansas Power & Light Co. Faced with Conflicting Orders Asks District Court at Washington to Settle Jurisdiction of Contending Authorities and to Enjoin FPC from Proceeding Further Till Question Is Settled

Charges that the Federal Power Commission is attempting unlawfully to usurp powers reserved to the Arkansas Department of Public Utilities are contained in a suit which the Arkansas Power & Light Co. has filed in the United States District Court for the District of Columbia, President C. Hamilton Moses of the utility announced.

Defendants are the FPC and its commissioners, Basil Manly, Leland Olds, Claude L. Draper, Nelson Lee Smith, and John W. Scott; and Arkansas DPU and its commissioners, Marvin Hathcoat, A. B. Hill and Charles C. Wine.

At issue is the question of whether the Arkansas DPU or FPC has jurisdiction over the primary books of accounts of the power company. The suit asks that a special three-judge court be appointed to determine the issue, and that the FPC be enjoined from proceeding further against A. P. & L. until this question is settled.

Has Complied with State Order

Last June the Arkansas DPU issued an order reclassifying accounts of the power company, and the suit sets out that the utility has already complied with provisions of this order. Early this month the FPC issued an order requiring the power company to show cause at a hearing in Washington on February 20 why A. P. & L. should not make other reclassifications which the power company contends are contrary to the orders of the Arkansas DPU.

The suit points out that the utility is subject to a fine of $1,000 a day for violating orders of the Arkansas department, while it is subject to "onerous and severe penalties" for violation of FPC orders.

"The threatened action of the Arkansas DPU and that proposed by the FPC raise a sharp conflict of jurisdiction between the agencies of the state of Arkansas and the United States, and the plaintiff is entitled to have this conflict clarified and determined before proceeding further in the case now pending before the FPC," the suit alleges.

It alleges further that "since the DPU has jurisdiction of plaintiff's security issues to the exclusion of the FPC, and since the books of the plaintiff kept in compliance with the DPU rules regulating accounting and its uniform system of accounts fulfill every convenience, requirement and necessity of the FPC in the discharge of its duties under the Federal Power Act, the plaintiff alleges that the jurisdiction over its primary, dominant and principal books of accounts is exclusively vested in DPU."

Allegation is also made that if the Federal Power Act gives the FPC jurisdiction over the books of the company those parts of the act granting this power are unconstitutional.

In its order against A. P. & L. the Arkansas DPU rejected the "Original Cost" theory of valuation which is advocated by the FPC, adopting instead the "prudent investment" theory. The Arkansas department held that there was actual value in the properties of the company in excess of the "Original Cost" to the first person devoting the properties to public service. The FPC is attempting to force the A. P. & L. to write out of its books any value in excess of "Original Cost." The Arkansas DPU held that this would be illegal destruction of values. The Pulaski Circuit Court at Little Rock upheld the order of the DPU, and later the Montana Public Service Commission adopted the same basis of valuation and cited the Arkansas order as "the outstanding ruling on the 'Original Cost' question.

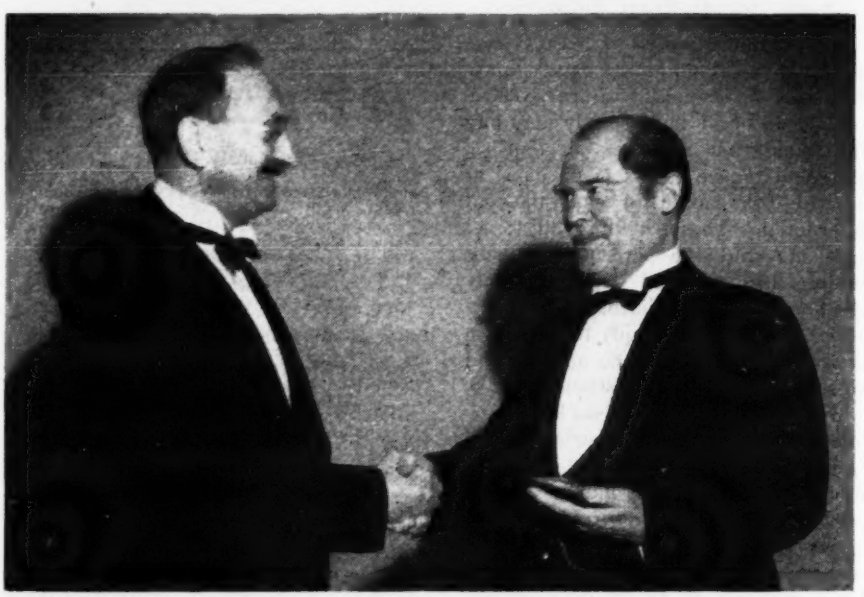
Since the question of whether federal or state jurisdiction over utility regulation affects practically all state regulatory agencies, it is expected that other states will join the Arkansas DPU in its announced intention of opposing the limit encroachment of the FPC.

Chairman Marvin Hathcoat has said "the department not only conceives it to be its duty under the law but a matter in the highest public interest to see that our jurisdiction is not destroyed and states' rights are preserved.

A few days before the A. P. & L. filed its suit for a declaratory judgment and injunction against the FPC, President C. H. Moses of the utility wrote War Mobilization Director Byrnes asking that the hearing against the power company scheduled for February 20 either be postponed for the duration or transferred to Arkansas "so that our business can be directed from the courtroom."

Pointing out that the FPC action promoted "definitely and vigorously" state rights, and can not contribute to the war effort he urged that the case be held in abeyance.

"It will require that our company send 30 people, all of whose services should be devoted specifically to operations, to Washington, with something like a truck load of books, typewriters, records and other equipment, for an indefinite period—apparently six to eight weeks," Mr. Moses told Director Byrnes.



CONGRATULATIONS FOR THE EDISON MEDALIST—Dr. Ernst F. W. Alexanderson, consulting engineer of the General Electric Co., receives the congratulations of Charles A. Powel, president of the American Institute of Electrical Engineers, following the presentation of the Edison Medal to Dr. Alexanderson last week at the A.I.E.E. convention

Coal Stockpiles Will Drop as Result of Rule Revision

Solid Fuels Administration Amends Regulation 23 to Limit More Sharply Coal Supplies of Utilities Supplied out of Eastern Production Districts—OWU Opposes Revision Claiming 30-Day Supply Necessary

Revisions of its Regulation 23 under which coal stockpiles of electric utilities supplied out of eastern production districts will be pulled down substantially have been issued by the Solid Fuels Administration for war.

No change was made in the regulation's preference table whereunder electric utilities rate behind by-product users and gas plants but ahead of "other industrial consumers."

Under one amendment, public utilities receiving coal by rail who buy in Districts 1, 2, 3, 4, 5, 6, and 13, and those who buy high-volatile coal from Districts 7 and 8 may buy 100 percent of their monthly burn when they have 35 days' supply on hand. Those receiving coal by rail and holding 36 to 50 days may buy monthly an amount not in excess of that required to reduce stocks to 35 days at the end of the month for which the order is placed. Those holding more than 50 days' may buy 50 percent of their monthly burn. Those holding 21 to 34 days and receiving by rail may buy 105 percent of their burn, and those holding less than 21 days may buy 110 percent.

Limit Supply From Tidewater

Those utilities receiving directly from tidewater and holding 45 days' supply may buy their monthly burn. Those holding 46 to 60 days' supply may buy an amount not in excess of that required to reduce stocks to 45 days' at the end of the month for which the coal is ordered. Those holding 30 to 44 days' may buy 105 percent and those holding less than 30 days' may buy 110 percent of their burn.

The above figures apply to coal from Districts 1, 2, 3, 4, 5, 6, and 13 and high-volatile coal from districts 7 and 8.

With a 25-day limit on stocks of low-volatile coal bought in Districts 7 and 8, utilities who receive by rail and hold 26 to 40 days' may buy an amount not in excess of that required to reduce stocks to 25 days' at the end of the month for which the coal is ordered. Those holding 16 to 24 days' stocks may buy 105 percent of their burn, and those holding less than 16 days may buy 110 percent.

Tidewater receivers of low-volatile from Districts 7 and 8 may buy 100 percent of their burn if they have 35 days' supply. Those holding from 36 to 50 days' may buy not to exceed that amount which will bring their stocks down to 35 days' at the end of the month for which it is ordered. Holders of more than 50 days' supply may buy only 50 percent of their burn. Those holding 21 to 34 days' may buy 105 percent, and those holding less than 21 days' may buy 110 percent.

In addition to reducing the standard stockpiles (those at which the full monthly burn may be ordered) the amendment lops five days off the margin accorded to tidewater receivers last year, leaving it at 10 days.

Another amendment directs producers who are unable to fulfill their commitments to ship first to industrial users, including utilities, who have less than 15 days' supply.

The new stock limitation table was opposed by the Office of War Utilities on two counts, but was instituted by SFAW regardless because of the severity of the supply situation. OWU argued that any electric utility which must operate with less than 30 days' supply is ipso facto in a dangerous position, and also that the limiting of utility purchases to a maximum of 110 percent of monthly burn prevents the rebuilding of depleted stocks in the quickest possible time. It asked that utilities with less than 30 days' supply to be allowed to build that level immediately and that the industry be granted a preference which would allow it to maintain 30-day supplies.

In general, it was conceded, utilities had more than the new standard stockpiles on Jan. 1, but the month of freezing weather which has elapsed, delaying deliveries and in some cases halting production for want of empty cars to fill at the mine, almost certainly has lowered the industry's average supply. Numerous plants have had their boiler capacities lowered by the use of frozen coal, as was the case at the Cleveland Electric Illuminating Co. just before the recent strike. Other companies which have attempted to collect coal from the broad base of a coal pile whose top has been removed and not replaced have experienced difficulty in obtaining manpower and tools to gather the coal.

Meanwhile, looking ahead to the forthcoming Great Lakes Shipping season, SFAW ordered that all contracts for Lakes shipments this year be filed by February 20. Its order also made stringent reductions in the amount of stockpiles which users in the territory supplied over the Lakes may have on March 31, 1946.

Despite the increasing stringency of fuel oil supply in the 17 Atlantic Coast states, Petroleum Administration for War does not expect now to cancel exceptions to Petroleum Distribution Order 13 under which some East Coast plants are obtaining oil. It is hoped that additional tankers will be available for this area in February. The Office of Defense Transportation, meanwhile, cracked down hard on tank car users, cutting the period before demurrage begins and raising demurrage rates sharply in an effort to cut the turnaround time of these cars. Another order limited the shipment of asphalt and certain other commodities in tank cars.

MEETINGS

Previously Listed

Pennsylvania Electric Association—Electrical equipment committee, Hotel Roosevelt, Pittsburgh, Pa., February 8-9; B. E. Hagy, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia, Pa. Transmission and distribution committee, Wm. Penn Hotel; Pittsburgh, Pa., February 15-16; M. M. Devorris, chairman, Pennsylvania Edison Co., Altoona, Pa.

Edison Electric Institute — Accident prevention committee, Cleveland Hotel, Cleveland, Ohio, February 8-9; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 13-14; transmission and distribution committee, Wm. Penn Hotel, Pittsburgh, Pa., February 15-16. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

American Society for Testing Materials—Committee week, Wm. Penn Hotel, Pittsburgh, Pa., February 26-March 2 (spring meeting) February 28. R. J. Painter, assistant to the secretary, 260 S. Broad St., Philadelphia 2, Pa.

Canadian Electrical Association—Annual western conference, Hotel Vancouver, Vancouver, B. C., March 14-16. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal 1, Que.

Southeastern Electric Exchange—Engineering and operation section, Henry Grady Hotel, Atlanta, Ga., March 22-23. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 3, Ga.

Motors Need AA-5 Rating

WPB emphasized recently that fractional horsepower motors made available for essential civilian and commercial replacements may neither be bought nor sold except with a rating of AA-5 or better.

Only sales which do not require ratings, WPB pointed out, are those on a farmer's purchase certificate under Priorities Regulation 19 or those in which a new motor is used for replacement of a damaged motor which is taken by the seller for reconditioning.

P.U.D. Freed by Injunction Dismissal to Take Utility

Injunction proceedings filed in Okanogan County, Washington, by Charles Rumbolz, the Washington Water Power Co., and others against Public Utility District, No. 1, of Okanogan County has been dismissed by Judge Ralph O. Olson of the Whatcom County Superior Court.

The action was brought to enjoin the P.U.D. from amending its previous resolution to meet the judgment in the condemnation proceeding. The P.U.D. originally provided that no more than $2,000,000 would be paid for the distribution system in Okanogan County, but the jury's verdict, with interest and costs, brings the amount up to more than $2,500,000.

Denial of the injunction leaves the way open for the entering of the decree of appropriation and taking over of the Okanogan System by the P.U.D. However, counsel for Washington Water Power Co. has said that an appeal will be made to the State Supreme Court for a stay of proceedings.

•

Court Denies Suspended Illinois Lawyer Rehearing

E. Bentley Hamilton, Peoria, one of the two attorneys suspended from practice in Illinois for three years because of alleged "unprofessional conduct" has been denied a rehearing by the Illinois Supreme Court.

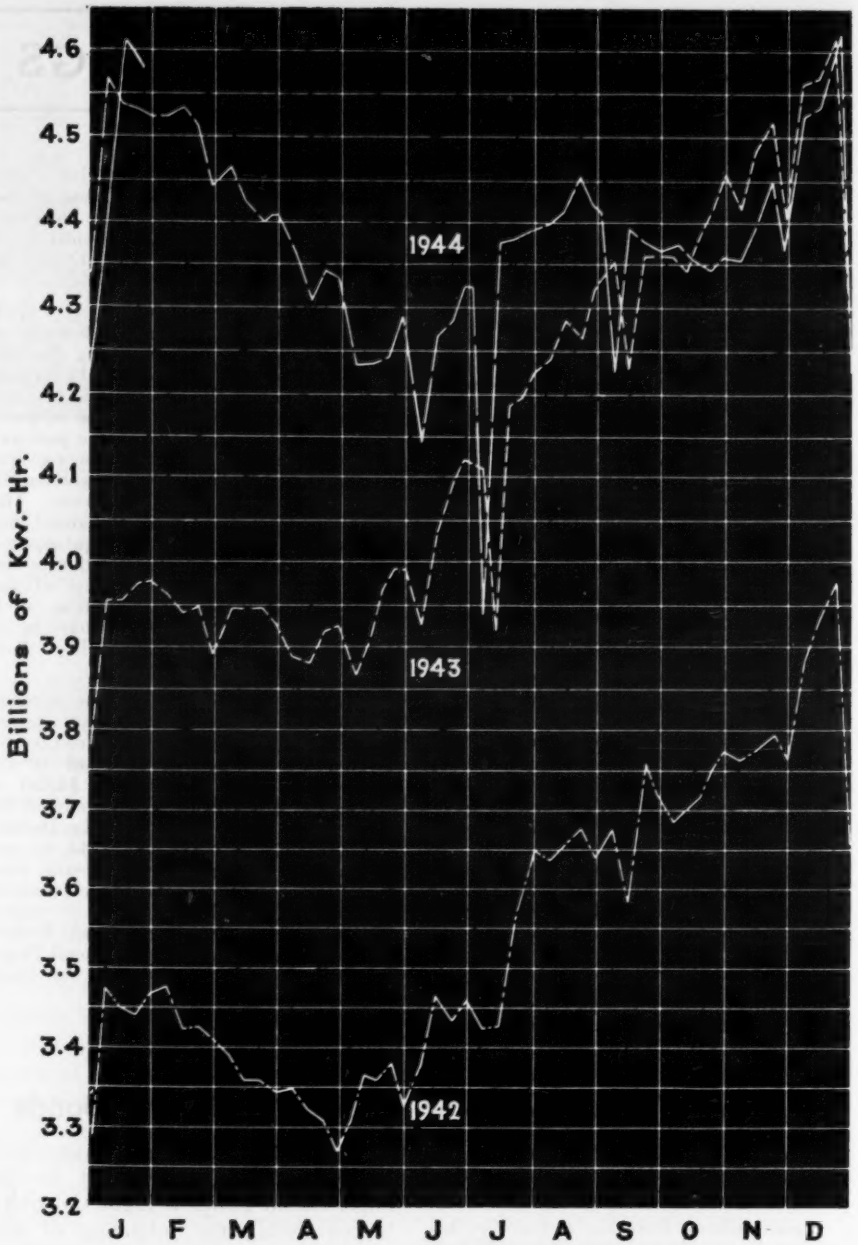
Hamilton and Benjamin P. Alschuler, Aurora, were suspended last November on charges by the State Bar Association that the two entered into an agreement with the Union Electric Co. of Missouri and other utilities for "kick backs" of large salaries.

The Bar Association alleged that they entered into an agreement with Frank J. Boehm, representative of the Union Electric, to turn back large sums of monies in the form of rebates. The court did not act on a pending rehearing petition by Alschuler.

•

Files Rural-Lines Plan

Arcade, Wyoming County, N. Y., which operates a municipal electric plant but serves parts of Freedom, Sardinia and Yorkshire in Cattaragus County, has filed a plan with the Public Service Commission under which it will make rural line extensions. A guarantee of a minimum gross revenue of $240 per mile of extension per year for a five-year period or a fractional amount in proportion to the length of the extension will be required.



Electric Output Moves Slightly Downward

The electric output curve during the week ended January 27, 1945, moved slightly downward, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,576,713,000 kw.-hr., compared with 4,588,214,000 kw.-hr. during the preceding week. During the week ended January 29, 1944, energy distributed amounted to 4,523,763,000 kw.-hr., this year's figure representing an increase of 1.2 percent.

Both the Rocky Mountain and the Pacific Coast groups again reported increased losses for the week ended January 27 over the corresponding period in 1944, as compared with the figures reposted for the week ended January 20.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
Jan. 27	4,577	Jan. 29	4,524	Jan. 30	3,977
Jan. 20	4,588	Jan. 22	4,532	Jan. 23	3,974
Jan. 13	4,614	Jan. 15	4,539	Jan. 16	3,952
Jan. 6	4,427	Jan. 8	4,568	Jan. 9	3,953
1944		1943		1942	
Dec. 30	4,226	Jan. 1	4,337*	Jan. 2	3,780†
Dec. 23	4,617	Dec. 25	4,296	Dec. 26	3,656
Dec. 16	4,563	Dec. 18	4,613	Dec. 19	3,976
Dec. 9	4,538	Dec. 11	4,567	Dec. 12	3,938
Dec. 2	4,524	Dec. 4	4,560	Dec. 5	3,884
Nov. 25	4,369	Nov. 27	4,403	Nov. 28	3,766
Nov. 18	4,450	Nov. 20	4,513	Nov. 21	3,795
Nov. 11	4,397	Nov. 13	4,483	Nov. 14	3,776

* 1944 † 1943

Percent Change from Previous Year

	Week Ending		
	Jan. 27	Jan. 20	Jan. 13
New England	+ 1.8	+ 2.5	+ 3.5
Mid Atlantic	— 0.2	— 0.9	— 0.7
Central Industrial	+ 4.1	+ 4.2	+ 3.4
West Central	+ 9.8	+10.6	+10.2
Southern States	+ 6.4	+ 5.3	+ 5.4
Rocky Mountain	—12.6	—11.1	— 9.6
Pacific Coast	— 5.4	— 3.6	— 0.2
Total United States	+ 1.2	+ 1.2	+ 1.7

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission, in a series of orders recently issued affecting utility companies:

HAS EXTENDED until March 27 the time in which the Associated Electric Co. may complete the sale of its interest in the Missouri General Utilities Co.

HAS APPROVED, subject to certain conditions, a plan filed by the Georgia Power & Light Co. and the Florida Power Corp., subsidiaries of the General Gas & Electric Corp., which provides for recapitalization of Georgia Power & Light. When all transactions will have been consummated direct control of Georgia Power & Light will be transferred to Florida Power by General Gas & Electric. The preferred stock of the Georgia utility will be eliminated and the company's debt reduced. The preferred stock of the Georgia company will be eliminated by paying its holders $150 a share in cash, plus 6 percent on the $100 par value from June 30, 1944. General Gas will donate to Florida all of Georgia's common stock and sell to Florida at its cost of $18 a share the 4,200 shares of Georgia's preferred stock that it owns. In addition, General Gas will donate to Florida $310,600 in cash. Florida, in turn, will donate to Georgia for cancellation the Georgia preferred stock purchased from General Gas. To provide Georgia with funds to retire its publicly held preferred stock and reduce its debt by $527,500, Florida will donate $1,400,000 to Georgia.

Applications Filed

NORTHERN STATES POWER CO. (Wis.) has asked for permission to retain steam heating properties of the Willow River Power Co. acquired with the purchase of Willow River's electric properties. The steam heating operating unit is in the same building with the Willow River steam-electric generating plant at Hudson, Wis., and does not lend itself to operation as a separate utility, Northern States stated in its application.

CONSOLIDATED ELECTRIC & GAS CO. has sought authority to raise $650,000 from three subsidiaries in connection with plan for retirement of entire $4,716,500 outstanding assumed first lien and collateral 5s, A, due April 1, 1958 of Southern Cities Utilities Co. Consolidated proposes to obtain funds from the subsidiary companies as follows: Haiti Co., $100,000; Santo Domingo Co., $250,000; and Roanoke Railway & Electric Co., $300,000. Payments by the subsidiary companies would be in the form of a reduction of principal on their respective notes owing to Consolidated. The proposed transactions are steps to provide company with some of the funds to discharge and retire its entire issue of assumed Southern Cities bonds.

Hearings Scheduled

FEBRUARY 5: On proposal of United Gas Improvement Co. to sell to the Philadelphia Electric Co. all the outstanding capital stock of its subsidiary, Chester County Light & Power Co. for a cash consideration of $614,881. Philadelphia Electric subsequently proposes to loan Chester County Light $280,250 on open book account to redeem as of June 1, 1945, all Chester's outstanding bonds in the principal amount of $267,000 at the redemption price of 105 and accrued interest. The purpose of the redemption program is to relieve Delaware Coach Co., another U.G.I. subsidiary, of its guaranty of principal and interest of the bonds.

FEBRUARY 6: On petition of Associated Gas & Electric Corp. for modification of an order issued in 1942 requiring the corporation to divest itself of its Philippine Island properties—Manila Electric Co. and Escudero Electric Service Co. The corporation said it has been asked by the post-war planning board of the Philippine Government in Exile to take part in the rehabilitation of its Philippine properties. The problems involved "will be substantial, not only in their financial and human aspects, but also with respect to the relation of the properties to the entire economy of the Philippine Islands," the petition said, adding that the properties may have to be restored for operation "on fairly short notice" at substantial cost.

FEBRUARY 12: To consider the application of Bartholomew A. Brickley, special counsel for International Hydro-Electric System, for commission approval of his $30,000 fee and approximately $4,850 in expenses. Mr. Brickley was appointed by the Federal District Court for the District of Massachusetts in October, 1943, as special counsel to investigate and make summary and exhaustive inquiry concerning transactions alleged to give rise to causes of action on behalf of International Hydro-Electric System against International Paper Co. He filed his report with the court November 1, 1944.

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Utility May Refund Bonds

Annual interest charges approximating $500,000 may be saved by the Puget Sound Power & Light Co. which is considering the refunding of first mortgage 4¼ percent bonds worth about $51,500,000. It has been indicated that the company, which is exhausting its carry-over tax credits and will move into the excess profits tax brackets in 1945, may be in a position to carry out the plan this spring. About $4,000,000 of additional property will be available for bonding by Puget Sound this year.

UTILITY REPORTS

	Net Income 1944	1943
*Connecticut Power	$2,055,106	$2,100,521
*Dallas Power & Light	1,443,134	1,386,412
†Mountain States Power	795,630	728,969
*Public Service New Jersey and subs	15,690,658	15,908,040
‡Southwestern Public Service	1,789,664	2,526,999
*Texas Electric Service	1,689,811	1,864,844
*Texas Power & Light	2,699,355	2,749,237

*Twelve months ended December 31.
†Twelve months ended November 30.
‡Twelve months ended October 31.

North Heads Cleveland League for 22nd Term

For the twenty-second consecutive time, J. E. North, sales manager of the Cleveland Electric Illuminating Co., has been elected president of the Electric League of Cleveland.

Other officers are A. F. Head, General Electric Supply Corp., and R. K. Howes, Higbee Co., vice-presidents; Harry Hutchinson, treasurer, and S. E. Strunk, secretary.

Directors are L. T. Blaisdell, General Electric Co.; John J. Bohning, George Worthington Co.; W. T. Clark, Cleveland Electric Illuminating Co.; William S. Fell, Enterprise Electric Lighting Fixtures, Inc.; James A. Foukal, Sterling & Welch Co.; Homer G. Frank, Strong, Carlisle & Hammond Co.; Carl E. Fruehauf, Fruehauf Hardware Co.; F. G. Hickling, Westinghouse Electric & Manufacturing Co.

F. J. Hopperton, Elliott Electric Co.; W. L. Howlett, Westinghouse Electric Supply Co.; Ralph Humbert, General Electric Co., Lamp Department, Buckeye Division; H. H. Kennedy, Frigidaire Division, General Motors Corp.; F. B. Maguire, W. Bingham Co.; H. L. Martien, Martien Electric Co.; and A. I. Perry, Graybar Electric Co.

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International Power Cuts Dividend Arrears by $5

International Power Co., Ltd., closed 1944 by paying a dividend of $5 a share on its first preferred stock on account of arrears and thus reducing the balance of arrears to $10 a share. Since 1941, the company has reduced its arrears to the extent of $21.25 a share. There are 80,000 shares of the first preferred $100-par shares outstanding. A quarterly dividend of $1.75 a share was also declared.

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Virginia Electric Will Sell All Transportation Lines

Virginia Electric & Power Co., which was ordered by the Securities and Exchange Commission to divest itself of its transportation properties, has called for bids by February 28 on the remaining transit facilities in Portsmouth, Petersburg, Newport News, Hampton, and Phoebus, Va.

The company has sold its Richmond and Norfolk transportation systems to the Equitable Securities Corp. and A. C. Allen & Co. which have set up the Virginia Transit Co. to operate them. These two companies are expected to be the principal bidders for the remaining facilities.

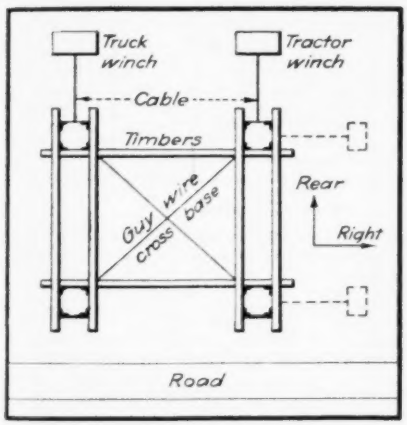
How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Substation Structure Moved Intact

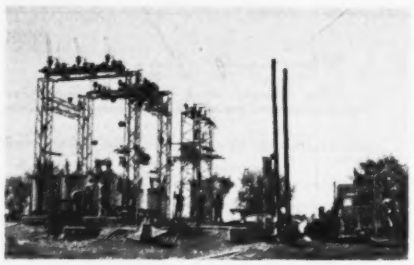
A 44-kv. substation was relocated, reconnected and put in service again by the Alabama Power Co. in 4 hr. and 22 min., or 38 min. less than permissible 5-hr. service interruption to dairies and cheese plants in the area. Because of road widening the new site for the substation was 22 ft. back and 10 ft. to the right of the old location.

Dismantling the structure and erecting it on its new site required too much time. George B. Foss, senior engineer, suggested that the structure be moved intact and this plan was adopted. The relocation involved the installation of new foundations and ground system together with a slight increase in area inclosed; otherwise no changes were made in equipment.



METHOD OF MOVING substation structure intact 22 ft. to the rear and 10 ft. to the right of its original location

On the location there are two separate substations—one serving a rural area and consisting of three 75-kva., 44/6.9-kv. delta-wye connected transformers, the other serving the town of Marion Junction and having three 50-kva., 44/2.4-kv. delta-delta connected transformers.



SUBSTATION RELOCATED and ready for reconnection to lines

All high-voltage switching equipment and high- and low-voltage buses for both substations are located on a common structure consisting of four columns with necessary girders. The low-voltage switching equipment for the rural substation is located on a separate structure, and that for the town of Marion Junction is in an outdoor cabinet.

All preparations for moving were completed in advance, including the bracing of the structures, construction of runways and installation of skids on the structure for use with rollers. Winches, trucks and tractors were used for the actual moving.

The rural oil circuit breaker was disconnected and moved, the feeder cabinet by-passed and relocated, and one of the three transformers on the town bank disconnected and relocated, all in advance of interruption of service. At 1 p.m. the high-side switch on the transformer bank serving the town of Marion Junction was opened and the other two transformers were moved to the new location. At 1:30 p.m. the switch on the rural transformer bank was opened and all high- and low-voltage feeders disconnected. Service to the town of Marion on the main 44-kv. line was restored within 50 min. At 1:56 p.m. the main structure was jacked up, then rollers were placed and moving started. The structure was moved back the required 22 ft. and then to the right the required 10 ft. Actual time the structure was in motion was eight minutes. Time from start of moving the main structure until bolted to new foundations was 1 hr., 40 min. During the period the main substation was being relocated the rural switch structure and bank of transformers were being moved to their new locations.

At 5:05 p.m. all transformers and lines had been reconnected and ready for service. At 5:52 p.m. all inspections had been completed, clearance obtained, grounds removed, the 44-kv. tap reconnected, and both substations were placed in service.

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Oscilloscope Measures Flicker Voltage

By E. R. WHITEHEAD
Investigating Engineer, Duquesne Light Co., Pittsburgh, Pa.

Various methods have been suggested for the measurement of so-called "flicker voltage" in the field. The term "flicker voltage" usually refers to voltage disturbances having a

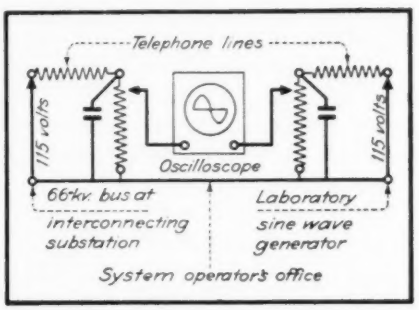

FIG. 1—Affected voltage compared by oscilloscope, in system operators' office with voltage from sine wave generator

definite frequency and approximately the same amplitude, such as those caused by "stitch" welders.

The measurement of disturbances occurring at random and having neither fixed frequency nor amplitude is most satisfactorily accomplished oscillographically. A problem of this nature recently arose in connection with the operation of an electronic frequency changer installed on a steel company system which was interconnected with the electric utility.

It was decided to compare the 66-kv. bus potential at the interconnecting substation with that of a stable standard source furnished by a sine-wave generator at the utility standardizing laboratory.

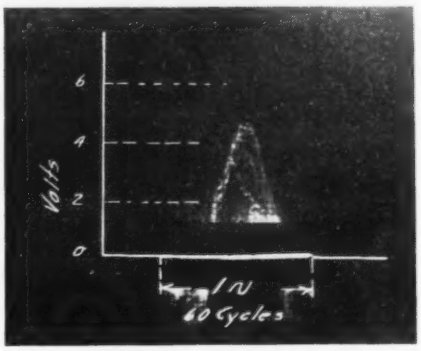

FIG. 2—Record of artificially produced electronic faults on electronic frequency converter. Scale is in r.m.s. volts

For convenience, both voltages were brought to the office of the system operator over telephone lines where the oscilloscope and resistance voltage dividers were connected as shown in Fig. 1. The slight phase shift caused by the capacitance of the telephone lines was compensated by adjusting the stator position of the sine wave generator, while accurate magnitude balance was obtained by the voltage dividers. In this way perfect fundamental frequency balance was achieved, leaving about one-half volt harmonic unbalance which was blanked out on the oscilloscope screen. The zero line was obtained by leaving a narrow slit in the blanking paper.

Fig. 2 shows one of a group of records obtained during a series of staged tests in which electronic faults were artificially produced in the frequency converter. The scale marking is a calibration in r.m.s. volts made by depressing the voltage at the interconnection station in accurate two-volt steps. This record shows eight fluctuations, which occurred in five seconds. The time intervals were measured from a high speed ammeter chart.

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Pre-Assembled Material Keeps Everybody Happy

"You don't need a slide rule to figure the net loss when six men stand around for an hour while material is being put up for whatever job is in progress."

This characteristically salty remark of a Wisconsin Public Service Corp. storekeeper explains why this company follows the procedure of segregating and putting up *in advance* as much of the material needed for individual construction and maintenance jobs as is possible.

The procedure followed revolves around the job "estimate" sheets, shown, on which electric departments are encouraged to furnish an estimate of the materials they will require for each construction or maintenance job. Job materials so specified are assem-

ESTIMATE SHEET

Date _____ 19___ Sheet No 1

Job _____ IR No. _____

Net Quan	Cr	Quan.	✓	Description of Item	Stock No	Cost	Ext.
				Poles			
				25 ft STP	3215		
				30 ft STP	3245		
				35 ft STP	3265		
				40 ft STP	[illegible]		
				Wire			
				Clamp, #3517 Hot Line	341500		
				Clamp, #3519 Hot Line	341502		
				Connector, #8 solid	342240		
				Connector, #6 solid	342260		
				Miscellaneous			
				Bolts, 1/2" x Machine	34		
				Brackets,	34		
				Clevises, #561 Insulated	341712		
				Clevises,	34		
				Insulators,	34		
				Insulators,	34		
				Nuts, 1/2" Pal	344565		
				Nuts, 5/8" Pal	344570		
				Washers,	34		
				Wire, W.P. Junk 20.56			
				Wire, Bare Junk 20.56			

Approved _____ Material Received _____

ESTIMATE SHEET

Date _____ 19___ Sheet No 4

Job _____ IR No. _____

Net Quan	Cr	Quan.	Description of Item	Stock No	Cost	Ext.
			Transformers, KVA Voltage			
			Meters, Wire			

Warehouse Charge No. _____

Warehouse Credit No. _____

JOB MATERIAL ESTIMATES FORM give storeroom advance notice of future job requirements. When the job comes up the material is segregated and ready. Crew "dead time" is eliminated

bled in advance at the warehouse. In some company localities the storeroom has material for five or six jobs properly segregated and set aside before actual construction begins.

This stores procedure, which has been used by Public Service for "quite some time," seems to suit everyone from the management down. Operating crews are interested in it because they are delayed very little at the warehouse even though there may be a number of crews coming in at one time for supplies. Store departments like this procedure because it spreads their work more evenly over the day.

The practice has been relatively easy to follow on construction jobs because of the long range planning that can be done; but it is not always practical on maintenance and storm repair work because there is a lack of planning time.

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Tower Corrosion Investigation

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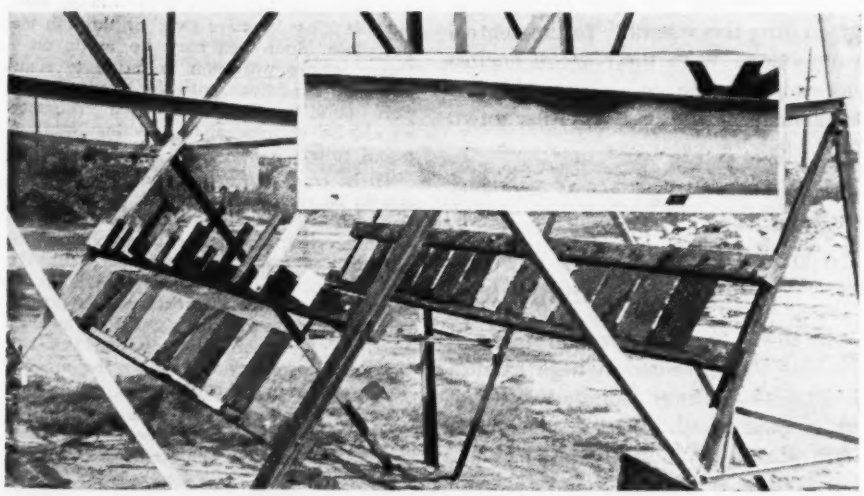
In addition to the 27 treated samples, the lower members of both towers in a double-tower structure have been covered with the same protective coatings used on the plates. All are numbered, tagged and recorded for identification. Regular inspections will be made to note results and after sufficient time has elapsed it is hoped that the most economical and effective method of prolonging the life of towers will be found.

Types of Priming Coats

	No. of Panels Exposed	
A.	14	Rust Inhibitive Pigmented
B.	4	Coal Tar Cut-back (Cold Application)
C.	2	Pigmented Synthetic Vehicle
D.	2	Asphaltic Emulsion
E.	2	Rust Inhibitive Pigmented Grease
F.	1	Clear Grease
G.	1	Clear Rust Neutralizer
H.	1	Special Varnish
I.	1	Control Panel. No Protective Covering Applied.

Types of Cover Coats

	No. of Panels Exposed	
A.	7	Aluminum Flake Pigmented (Various Vehicles)
B.	4	Coal Tar or Bitumastic (Cold Application)
C.	2	Pigmented Synthetic Vehicle
D.	2	Asphaltic Emulsion
E.	1	Clear Grease (Over Priming Coat "H")
F.	4	Inorganic Compounds Pigmented (Various Vehicles)
G.	2	Graphite Pigmented (Oil Vehicles)
H.	1	Aluminum Flake Pigmented Grease (Over Priming Coat "F")
I.	1	Control Panel — No Protective Covering Applied



27 STEEL TEST PANELS, each with a different kind of preservative, have been mounted in tower base to secure life and effectiveness data on tower member protection under actual field conditions. Upper insert shows rusting of tower member due to chemical fumes and salty atmosphere after 16 yr. of service

Tower Thoroughly Cleaned

Tower members which were coated were wire-brushed and wiped off throughout their length preliminary to application of the initial coat. In addition, a 1-ft. length at the lower end of each section was cleaned thoroughly down to bright metal. This second cleaning was performed with scrapers and emery cloth. This was done to see what improvement will result in the long-time protection of the steel members when given an unusually careful cleaning as compared to a superficial cleaning before application of the protective coatings.

The question of how much or how little cleaning will be necessary is a most important consideration as the cost of cleaning towers by sandblasting, wire brush, scraping or other means could easily exceed many times over the cost of labor and material for applying a protective coating.

Samples in Industrial Area

The particular bridge-structure tower line on which the samples have been placed carries seven 66-kv. circuits. The line, in service 16 yrs., traverses an industrial area in the vicinity of the ocean where the towers are subjected to fumes and dust from chemical plants and from air-borne salt spray from the ocean, a combination that has proven severe for an admittedly good original galvanizing job.

Tower footings are a problem separate from this rusting of upper members and has been under study on a system-wide basis for many years, being attacked both by preservative coatings and cathodic protection. Both lines of experimental investigation are under the direction of Fred B. Doolittle and E. R. Stauffacher, of

definite frequency and approximately the same amplitude, such as those caused by "stitch" welders.

The measurement of disturbances occurring at random and having neither fixed frequency nor amplitude is most satisfactorily accomplished oscillographically. A problem of this nature recently arose in connection with the operation of an electronic frequency changer installed on a steel company system which was interconnected with the electric utility.

It was decided to compare the 66-kv. bus potential at the interconnecting substation with that of a stable standard source furnished by a sine-wave generator at the utility standardizing laboratory.

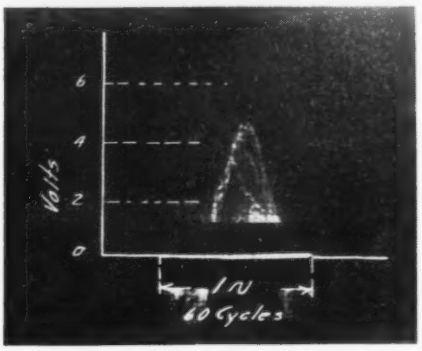


FIG. 2—Record of artificially produced electronic faults on electronic frequency converter. Scale is in r.m.s. volts

For convenience, both voltages were brought to the office of the system operator over telephone lines where the oscilloscope and resistance voltage dividers were connected as shown in Fig. 1. The slight phase shift caused by the capacitance of the telephone lines was compensated by adjusting the stator position of the sine wave generator, while accurate magnitude balance was obtained by the voltage dividers. In this way perfect fundamental frequency balance was achieved, leaving about one-half volt harmonic unbalance which was blanked out on the oscilloscope screen. The zero line was obtained by leaving a narrow slit in the blanking paper.

Fig. 2 shows one of a group of records obtained during a series of staged tests in which electronic faults were artificially produced in the frequency converter. The scale marking is a calibration in r.m.s. volts made by depressing the voltage at the interconnection station in accurate two-volt steps. This record shows eight fluctuations, which occurred in five seconds. The time intervals were measured from a high speed ammeter chart.

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Pre-Assembled Material Keeps Everybody Happy

"You don't need a slide rule to figure the net loss when six men stand around for an hour while material is being put up for whatever job is in progress."

This characteristically salty remark of a Wisconsin Public Service Corp. storekeeper explains why this company follows the procedure of segregating and putting up *in advance* as much of the material needed for individual construction and maintenance jobs as is possible.

The procedure followed revolves around the job "estimate" sheets, shown, on which electric departments are encouraged to furnish an estimate of the materials they will require for each construction or maintenance job. Job materials so specified are assem-

ESTIMATE SHEET

Date_____ 19___ Sheet No 1

Job_____ IR No. _____

Net Quan	Cr	Quan.	✓	Description of Item	Stock No	Cost	Ext.
				Poles			
				25 ft SYP	3215		
				30 ft SYP	3245		
				35 ft SYP	3265		
				40 ft SYP	3275		
				Wire			
				Clamp, #3517 Hot Line	341500		
				Clamp, #3519 Hot Line	341502		
				Connector, #8 solid	342240		
				Connector, #6 solid	342260		
				Miscellaneous			
				Bolts, 1/2" x Machine	34		
				Brackets,	34		
				Clevises, #561 Insulated	341712		
				Clevises,	34		
				Insulators,	34		
				Insulators,	34		
				Nuts, 1/2" Pal	344565		
				Nuts, 5/8" Pal	344570		
				Washers,	34		
				Wire, W.P. Junk 20.56			
				Wire, Bare Junk 20.56			

Approved _____ Material Received_____

ESTIMATE SHEET

Date _____ 19 ___ Sheet No 4

Job_____ IR No._____

Net Quan	Cr	Quan.	Description of Item	Stock No	Cost	Ext.
			Transformers, KVA Voltage			
			Meters, Wire			

Warehouse Charge No. _____

Warehouse Credit No. _____

JOB MATERIAL ESTIMATES FORM give storeroom advance notice of future job requirements. When the job comes up the material is segregated and ready. Crew "dead time" is eliminated

bled in advance at the warehouse. In some company localities the storeroom has material for five or six jobs properly segregated and set aside before actual construction begins.

This stores procedure, which has been used by Public Service for "quite some time," seems to suit everyone from the management down. Operating crews are interested in it because they are delayed very little at the warehouse even though there may be a number of crews coming in at one time for supplies. Store departments like this procedure because it spreads their work more evenly over the day.

The practice has been relatively easy to follow on construction jobs because of the long range planning that can be done; but it is not always practical on maintenance and storm repair work because there is a lack of planning time.

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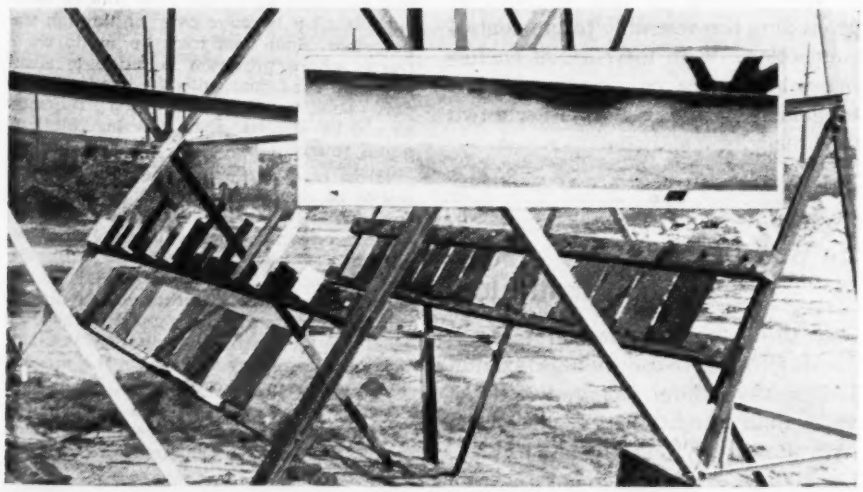

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the general office engineering staff, and L. L. Baskette, chemist for Southern California Edison Co.

The experimental protective coatings now undergoing exposure tests are listed by general types.

One heavy coat *only* was applied in the case of certain greases and coal tar compounds. These one-coat applications are included in the listing of "Priming Coats."

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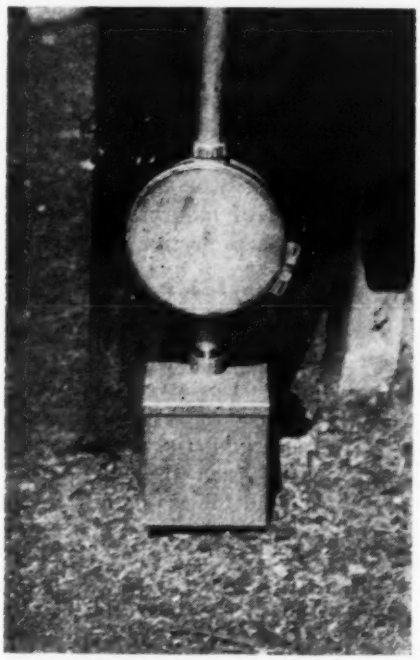
Pre-Fabricated Assembly for Rural Service

Accompanying illustrations show the pre-fabricated, pole mounting meter and service switch assembly that is used by the Nebraska Power Co. in its rural service area.

Instead of running a service loop to the customer's dwelling and making the usual socket meter and service switch installation on private premises the Omaha company follows the practice in rural areas of mounting the meter and switch on the transformer pole from which service is taken.

Service assemblies for installation



CLOSE UP VIEW of meter socket and service box

in this manner are pre-fabricated in the store room by the service department ready for quick installation in the field. The assembly consists of a 5-ft. and a 10-ft. length of 1-in. thin-wall conduit joined by a threadless coupling, (the assembly is stored with conduit uncoupled). Lower end of the conduit terminates in a meter socket, closed off with a wooden disk when not in use, and a service box with pull-out type cartridge fuse block which acts as service switch. Upper end of the conduit terminates in a 4-wire service head. A white wire and ground clamp is fastened to the conduit for the purpose of grounding the assembly to the neutral connection. With the conduit enclosing four service conductors this arrangement permits use of either a two or three-wire meter.

CUSTOMER'S METER and service assembly for rural use is prefabricated for rapid pole mounting

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Re-Use of High Tension Insulators

In order to avoid premature trouble due to the re-use of high tension insulators without adequate checks upon their condition, the New England Power System, Boston, Mass., has established the following program covering the testing and handling of salvaged insulators:

1. Insulator failures in service are classified under three general headings:

A. Failure from electrical stresses.

B. Internal mechanical stresses due to the manner of assembly.

C. External mechanical loadings.

The most likely causes are the two first mentioned. In the re-use of salvaged insulators it is important to be sure that progressive deterioration from one or the other has not already set in and to guard against failures from the redistribution of mechanical stress after relief from such stress.

2. The following procedure for the re-use of these insulators is therefore recommended:

A. Upon removal from the line each insulator should be carefully wiped and inspected for cracks or chips, the presence of either of which should be cause for disposing of the insulator without further ado. Hidden cracks can be detected only by very carefully tapping the porcelain shells with a light wooden handle. The glaze should have a uniform color and a bright and life-like appearance.

B. Disc insulators, which are less than 5 years old and are of modern construction, may be thereupon taken back into stock and re-used for all ordinary purposes. Pin type insulators, which are less than 5 years old and are of modern design, may also be taken into stock after visual inspection provided a Doble test has been sustained in the previous six months.

C. Insulators which are over 5 years old but less than 10, shall be tested as below before further use:

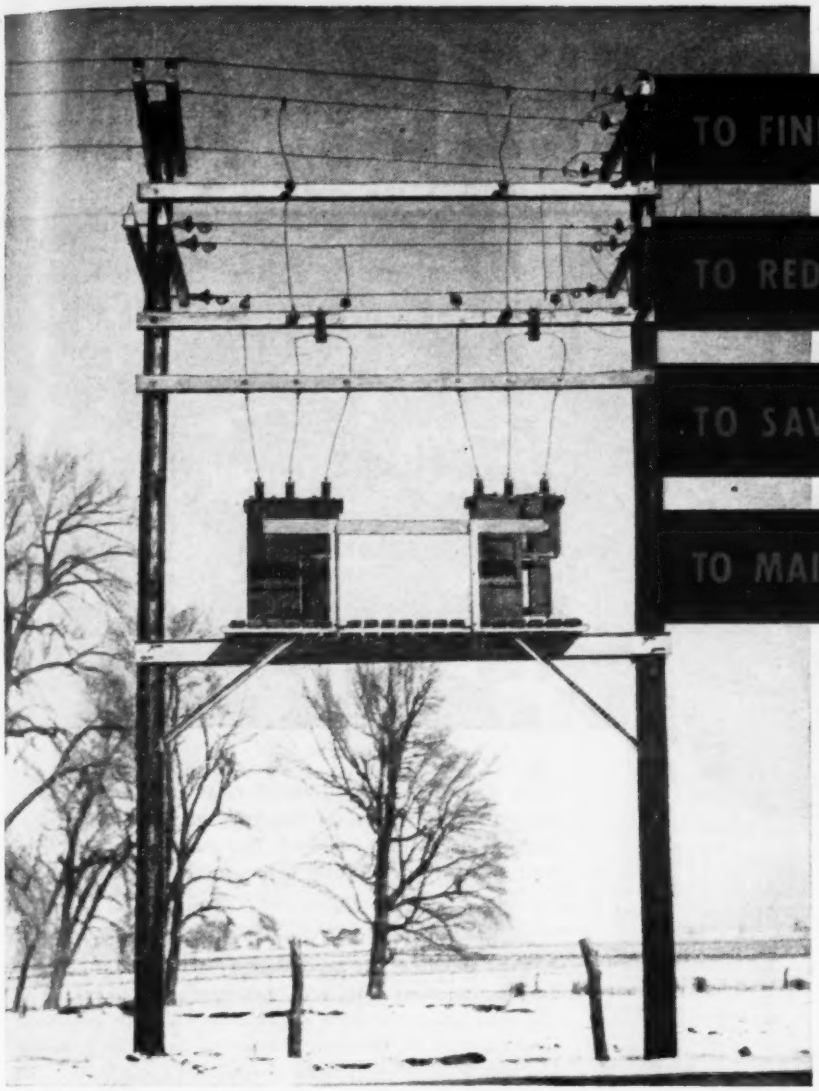
(1) The test shall consist of the application of a 60-cycle voltage sufficient to cause vigorous flashover between the tie wire and pin, or corresponding parts on disc insulators. In case the voltage available is not sufficient to flashover the entire unit, this test may be made by flashing over single shells at a time, but in such cases the use of the ensuing alternative test is preferable. The failure of any shell by puncture instead of flashover shall be cause for rejection.

(2) As an alternative for the flashover test, a Doble test may be made when current is available from a source which will maintain full rated line voltage without effect by leakage over or through the porcelain. Such test may be made on a frame where provision is made to simulate field conditions with the insulator support solidly grounded. Test readings should be equivalent to new insulators of equal rating.

(3) In case large numbers of insulators are to be removed from service it may be less expensive to Doble-test the whole installation in place immediately before removal is started and dispense with the test 2C1 or 2C2. In such case visual inspection for chips or cracks must not be relaxed and extra care should be used in handling those units which are suitable. It is also necessary to observe the precaution mentioned in Paragraph F.

(4) Whichever test is most convenient should be done only under the personal supervision of a competent and experienced test man.

D. No restriction should be placed on the voltage at which second-hand insulators may be used after having passed the above test, except those which apply on standard insulators for the same serv-



TO FIND HIDDEN KILOWATTS

TO REDUCE SYSTEM COSTS

TO SAVE MATERIALS

TO MAINTAIN SERVICE STANDARDS

Your best bet for rural circuits—Low-cost ML-4 step voltage regulators, like these, usually represent the most economical method of voltage regulation on rural circuits. Hundreds of such installations, made during the past few years, have proved their effectiveness. They help get full voltage, improve appliance performance and life, increase consumer good will, and build load.

Keep the Voltage UP with Regulators

OBVIOUSLY, you will find it a lot easier to handle the distribution problems that arise from war loads, one or two shifts instead of three, and reconversion, if you can get the voltage up and hold it there.

Feeder voltage regulators are *made* for this job. The investment is small when compared with other voltage-improvement methods; little construction material and relatively few man-hours are required for installation. They are a "natural" for voltage problems that must be solved in a matter of weeks, not months.

Remember, too, aside from the improved service they make possible, that "there's revenue in regulators." They are still near the top of the list of good self-liquidating investments. Actual case histories indicate annual savings of from $834 to $9950 *on a single feeder*.

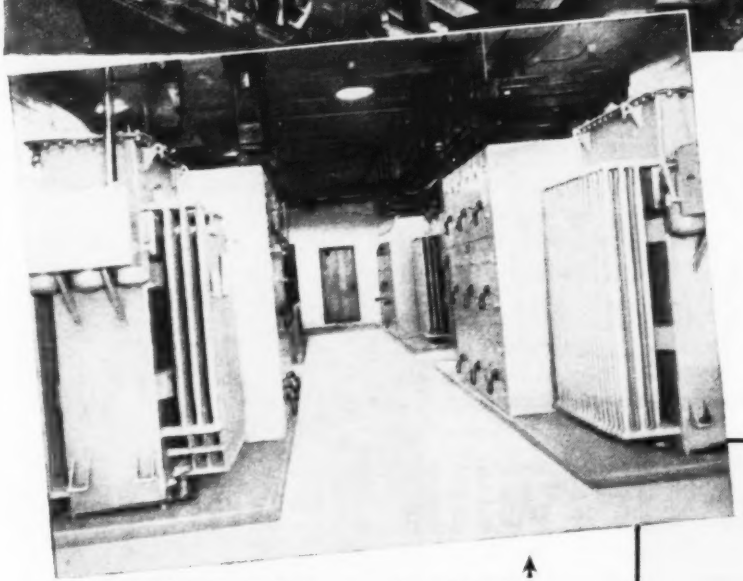
A wide range of G-E feeder voltage regulators can be obtained promptly from stock—for automatic control on circuits from 120 to 69,000 volts. Induction and step types—in oil-filled, Pyranol, and dry-type designs—permit choice of a regulator exactly suited to your needs. For complete listing information, ask for Bulletin GEA-4276. *General Electric Company, Schenectady 5, N. Y.*

Buy all the BONDS you can—and keep all you buy

GENERAL ELECTRIC

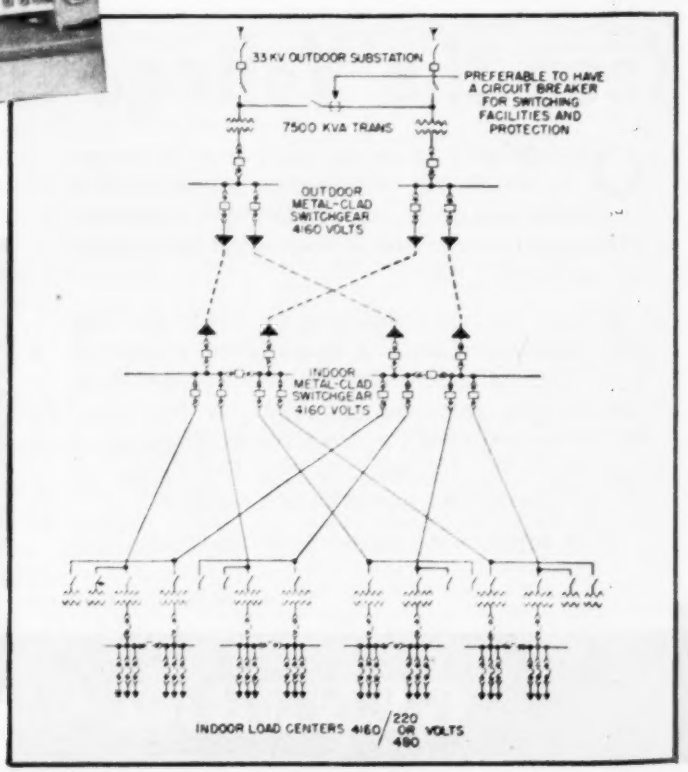
NO "FREEZE" ON

Over the vast floor area of this windowless plant, power taps are close at hand for machines and lighting panels. Metal-enclosed bus runs come up from unit substations directly below in the basement.



A group of G-E load-center unit substations, showing high-voltage lines entering in interlocked-armor cable and the outgoing low-voltage metal-enclosed bus runs. Each load-center unit has two incoming lines.

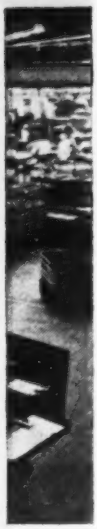
"One-line diagram" of part of the power distribution circuit, showing the secondary-selective arrangement. Interconnection through sectionalizing breakers in the secondary provides an alternate supply in case of interruption in primary feeder or secondary transformer.


33 KV OUTDOOR SUBSTATION
PREFERABLE TO HAVE A CIRCUIT BREAKER FOR SWITCHING FACILITIES AND PROTECTION
7500 KVA TRANS
OUTDOOR METAL-CLAD SWITCHGEAR 4160 VOLTS
INDOOR METAL-CLAD SWITCHGEAR 4160 VOLTS
INDOOR LOAD CENTERS 4160/220 OR 480 VOLTS

LOAD-CENTER Power Distribution Systems

MACHINE LOCATION

at a plant with a load-center power system



Output has stayed high in this aircraft-engine plant, in spite of work changeovers that require relocation of many machines. In one three-month period, more than 2000 machines were shifted, but these machines never stood idle for lack of electric energy.

Why was full-voltage power so quickly available for every machine, no matter where located? Why has the plant management such complete *freedom* in planning tomorrow's work flow and machine location?

First, because when the plant was built, *power flow was put on a par with production flow.*

Such advanced features of plant design as windowless, air-conditioned construction could be adopted without misgivings—because the secondary-selective distribution system gives unusual protection to power continuity. It helps make a plant-wide blackout virtually impossible.

Second, because *the distribution system is of the modern load-center type.*

Individual G-E unit substations are located in the basement, for the most part directly below the load areas they serve. Primary power is distributed to these units at 4160 volts, each load-center substation having two incoming lines. Secondary circuits, each with its individual breaker, consist of short, metal-enclosed bus runs, passing up through the floor and above the work area, with power taps of Flamenol† cable to the machines.

Third, because metal-clad switchgear and unit substations were selected for the job.

A transformer section using Pyranol*, which is non-burning, permits G-E unit substations to be installed without vaults wherever the loads require them. G-E switchgear assures *adequate* interrupting capacity. Increased loads requiring more transformer capacity can be supplied with additional easily installed units.

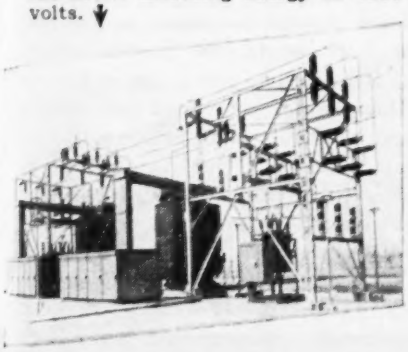
Before you settle on your plans for plant reconversion with respect to power supply, why not review the experience of plants that have adopted *load-center distribution?* G-E application engineers will be glad to give you facts and figures for immediate or postwar consideration. *General Electric Company, Schenectady 5, N. Y.*

†*Reg. U.S. Pat. Off.*

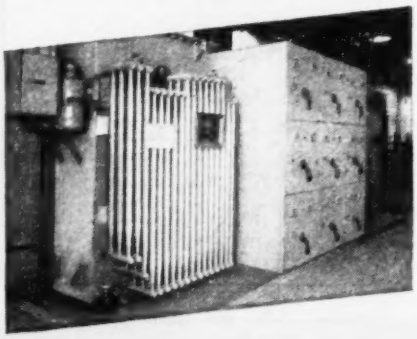
**Trade-mark for General Electric's nonsludging, insulating and cooling liquid that will not burn*

Write for this new booklet—"Load-center Unit Substations" (GEA-3592) gives valuable information on planning a fully modern power system, shows installation in many plants.

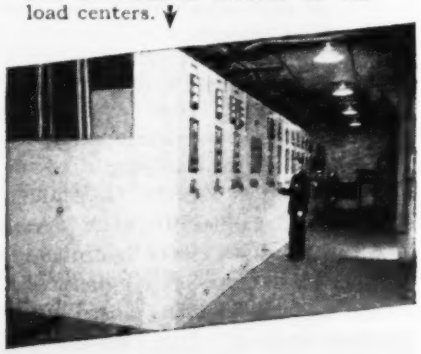
At this outdoor substation, two G-E 7500-kva transformers step down the 33-kv incoming energy to 4160 volts.



Close-up of G-E unit substation showing Pyranol transformer and metal-enclosed, drawout air circuit breakers.



Indoor vertical-lift metal-clad switchgear protects incoming lines and distribution feeders to the load centers.



GENERAL ELECTRIC

BUY WAR BONDS

302-35

ice; that is, the manufacturer's rated dry and wet flashovers shall not be less than those required under standard practice.

E. Insulators accepted into stock for further use, after either visual or electrical test, should thereafter receive careful handling since such insulators are damaged to a greater extent by rough handling than new crated or boxed insulators.

F. If at all feasible all second-hand insulators should be given a Doble test soon after reinstallation, since the redistribution of mechanical stress sometimes causes failures in aged porcelain and such failure may occur after the insulators have been tested for stock.

G. Insulators exceeding 10 years in age should be re-used only with the greatest caution. Experience has indicated that the expectancy of trouble-free service from units made before 1923, is about 12 to 15 years. The re-use of such insulators is therefore a doubtful economy due to the expense of changing units which go bad within a brief period. This expense in most cases will equal or exceed the cost of a new insulator.

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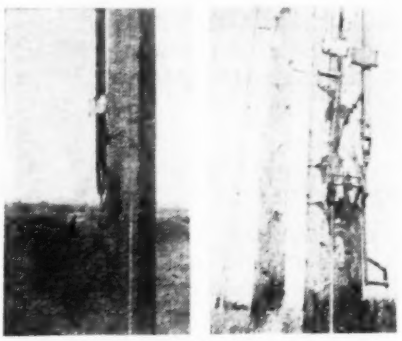
Simple Mechanical Air-switch Interlock

A simple interlock for two air-switches located on separate poles, consisting of a flexible steel cable



FLEXIBLE steel cable passing through underground pipe connects operating levers of air-switches on separate poles to form simple and inexpensive interlock. Conduit extending up pole and loop of slack cable may be seen in one of the photographs

enclosed in a pipe and connecting the operating rods of the two switches, has been developed by G. H. Harkness of the San Jose division of Pacific Gas & Electric Co., and several are in use in that division. When one switch is open and the other closed, the cable is taut, so that neither switch can be closed until the other is open. This prevents paralleling of two high-voltage supply lines to a customer's service.

The cable is attached permanently to one switch lever and with a padlock to the other so that authorized power company men can remove the interlock and close both switches if desired. The arrangement is of primary advantage where customer's personnel is permitted to switch sources of supply in case of an interruption, thus reducing outage time. The scheme is applicable whether the switch poles be close together or located some distance apart.

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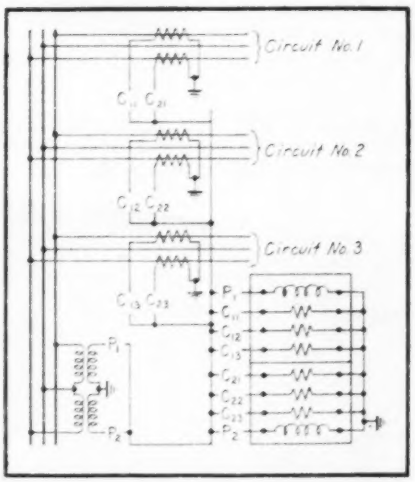
Meter Revised to Totalize Three Lines

Totalization of watt-hour meter readings on three lines from a substation of the East Tennessee Light & Power Co. was desired. Special metering equipment being difficult to obtain under war conditions, a local solution to the problem was sought. It was found in revision of the current coils of an available watt-hour demand meter.

This was a two-element meter rated at 5 amp. The current coils were removed and replace with three separate coils, each with half the number of turns of the original one, about all the wire that could readily be wound on the core. The rating of the meter thus was raised to 10 amp. and its disc constant doubled, a change easily compensated for by halving the gear ratio of the register. The potential coils required no change as the three lines issued from the one bus and phase positions were identical. Holes were



CONNECTION of triple-current-coil meter to three lines

drilled in the meter base for the additional connections which were brought out in ¼-in. brass studs insulated with micarta tubing.

Electric Heat Removes Small-Wire Insulation

By C. PORTER
Electric Appliance Division
Westinghouse Electric & Manufacturing Co.
Mansfield, Ohio

Burning insulation from small wires with electric heat is a process that had been used previously by some Westinghouse divisions instead of the scraping method preparatory to making connections. However, the equipment shown in the accompanying illustration was subjected to some refinements to enable it to take the insulation off very small stranded wire from conductor size No. 12 down to No. 26.

The apparatus consists of two electrically-heated elements each mounted in a vertical position and having a

INSULATION is burned from very small stranded wire by means of electrically heated elements

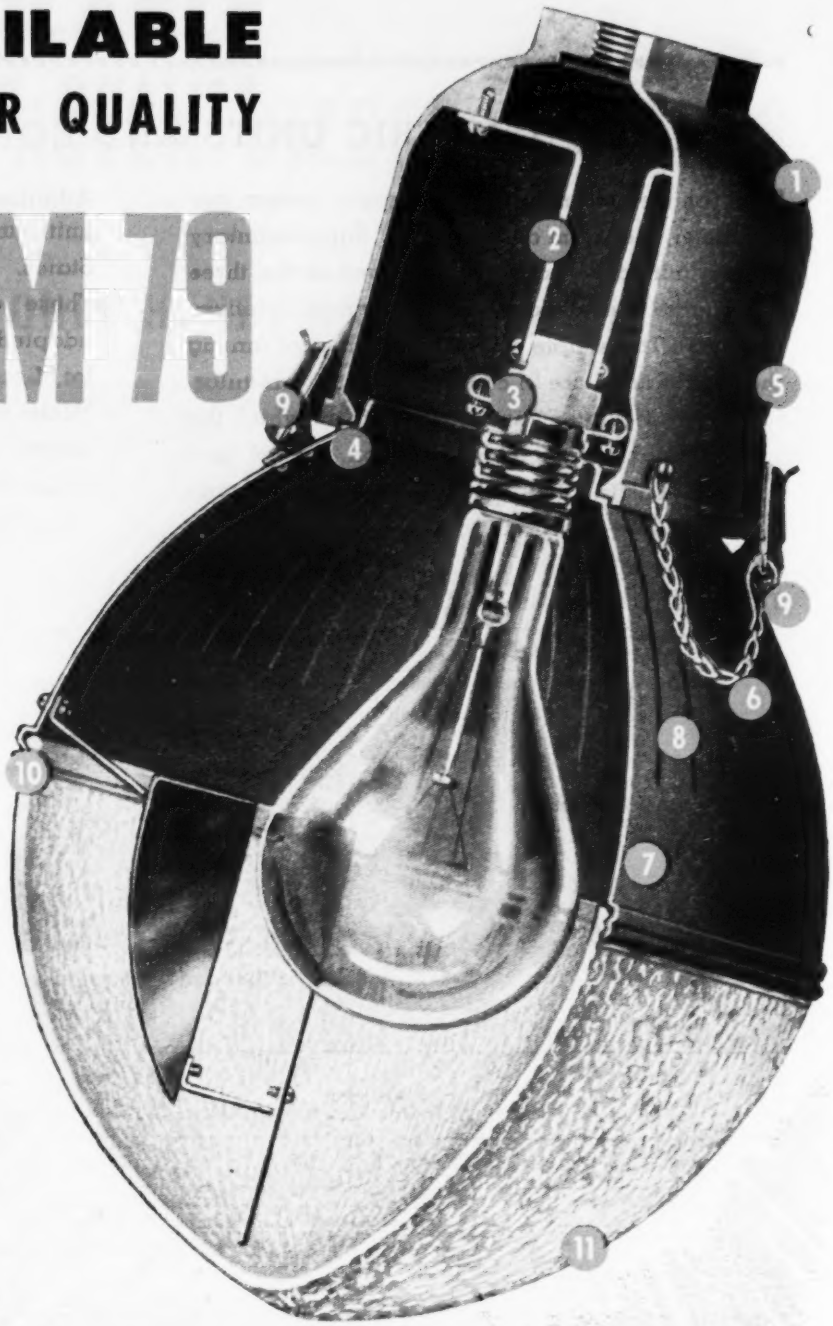
work-face of 0.5 in. for burning insulation. These elements are kept at red heat by the flow of electric current through them. The amount of heat is controlled by means of rheostats mounted under the bench. Total current consumed is 150 amp. at 0.3 volts for the heating device.

Steps in the process are as follows: The operator takes four or five wires and positions them between the two hot elements. Then pressure is applied on the foot treadle which brings the two elements together and squeezes them against the wires. Next the operator then draws the wires toward her and through the elements. During this passage the insulation is burned off, leaving the clean copper ready for soldering.

The hood and exhaust pipe are for the purpose of carrying away the fumes from burning insulation.

AGAIN AVAILABLE
PREWAR QUALITY

Novalux **FORM 79**



WITH THESE EXPENSE-SAVING FEATURES

1 Cast-aluminum hood—light, strong, non-rusting

2 Sockets and receptacles securely mounted—assure correct focus throughout life

3 Heavy-duty, long-life sockets and receptacles—large terminals for easy wiring

4 Weather, dirt, and insects excluded without depending on gasket

5 Attractive, natural aluminum finish—no painting required

6 Suspension chain for reflector—frees both hands

7 Alzak* finished aluminum reflector—highly efficient, lightweight, durable

8 Steps protect lamp stem from heat concentration

9 Spring toggle latches make servicing easy

10 Spun-sealed assembly keeps interior clean, reduces glassware breakage cost to less than 10 cents average per luminaire per year

11 Long-life Holophane refractor or clear-glass globe, pressed for uniform thickness, rippled for proper diffusion and sparkle

Simple exchange plan provides low-cost, fully reconditioned reflector assembly for replacing broken glassware

*Manufactured under Aluminum Company of America Patents.

Units of the Form 79 family are available with hoods, insulators, and reflectors to meet any local condition of mounting or desired light distribution. G-E specialists in street lighting and the G-E Illuminating Laboratory will help you apply them to best advantage, or help you plan a comprehensive modernization project for the future. *General Electric Company, Schenectady 5, N. Y.*

Novalux STREET LIGHTING for TRAFFIC SAFETY

Are you tieing in with the NEMA Plan to give America better street lighting? Remember . . . . GOOD STREET LIGHTING BUILDS GOOD WILL.

Buy all the BONDS you can—*and keep all you buy*

GENERAL ELECTRIC

452-27-3019

METRIC UNITS AND EQUIVALENTS

Units of measurement in the metric system are the meter, the gram and the liter. Supplementary metric units are decimal derivatives of the three units and are denoted by numerical prefixes (Table 1). The simple relations which exist among the metric units are in contrast with the irregularity of United States customary units, in which the fundamentals are the yard, gallon, bushel and pound. Electrical units and centimeter-gram-second (CGS) units are based on metric units.

Additional tables list conversion factors for metric units and units in common usage in the United States, particularly in the electrical industry. These data on length and area have been adapted from National Bureau of Standards booklet Miscellaneous Publication M121 (1936), entitled "Units of Weight and Measure", with revisions. Tables for classifications of volume, capacity, mass, and atmospheric and water pressure will be published in a subsequent issue.

Table 1—Prefixes and Units of the Metric System

Prefixes		Meaning		Units
milli-	=	$\frac{1}{1000}$	0.001	
centi-	=	$\frac{1}{100}$	0.01	"meter" for length
deci-	=	$\frac{1}{10}$	0.1	
Unit	=	1	1	
deka-	=	$\frac{10}{1}$	10	"gram" for weight or mass
hecto-	=	$\frac{100}{1}$	100	
kilo-	=	$\frac{1000}{1}$	1 000	"liter" for capacity
mega-	=	$\frac{1\ 000\ 000}{1}$	1 000 000	

Table 2—Specific Equivalents

Units		Equivalents	
1 meter	=	1,553,164.13	wave lengths (red cadmium light waves)
1 micron (μ)	=	0.000,001	meter
		0.001	millimeter
1 millimicron (mμ)	=	0.000,001	millimeter
1 angstrom (Å)	=	0.000,000,1	millimeter
		0.000,1	micron
		0.1	millimicron
1 liter	=	1.000,028	cubic decimeters
1 point (printers)	=	0.013,889	inch
1 mil (0.001 inch)	=	0.000,025,4	meter
1 square mile	=	640	acres
1 acre-foot	=	325,851	U. S. gallons
		1,613	cubic yards
		1,233,489	cubic meters
1 pound (avdp.)	=	453,592,428	grams
1 quart (dry)	=	1.101,198	liters
1 quart (Liquid	=	0.946,333	liters

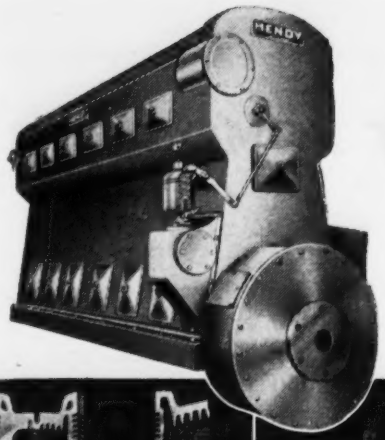
Table 3—Units of Length

Units		Inches	Feet	Yards	Miles	Centimeters	Meters
1 inch (in.)	=	1	0.083,333,3	0.027,777,8	0.000,015,782,8	2.540,005	0.025,400,05
1 foot (ft.)	=	12	1	0.333,333	0.000,189,393,9	30.480,06	0.304,800,6
1 yard (yd.)	=	36	3	1	0.000,568,182	91.440,18	0.914,401,8
1 mile (mi.)	=	63,360	5,280	1,760	1	160,934.72	1,609,347.2
1 centimeter (cm.)	=	0.3937	0.032,808,33	0.010,936,111	0.000,006,213,699	1	0.01
1 meter (m.)	=	39.37	3.280,833	1.093,611,1	0.000,621,369,9	100	1

Table 4—Units of Area

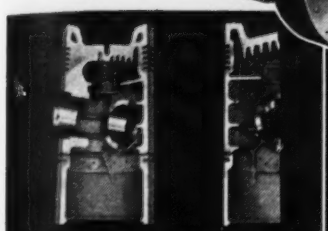
Units		Square Inches	Square Feet	Square Yards	Acres
1 square inch (sq.in.)	=	1	0.006,944,44	0.000,771,605	0.000,000,159,423
1 square foot (sq.ft.)	=	144	1	0.111,111,1	0.000,022,956,8
1 square yard (sq.yd.)	=	1,296	9	1	0.000,206,612
1 acre (acre)	=	6,272,640	43,560	4,840	1
1 square mile (sq.mi.)	=	4,014,489,600	27,878,400	3,097,600	640
1 square centimeter (cm.²)	=	0.154,999,7	0.001,076,387	0.000,119,598,5	0.000,000,024,710,4
1 square meter (m.²)	=	1,549.996,9	10.763,87	1.195,985	0.000,247,104
1 hectare (ha.)	=	15,499,969	107,638.7	11,959.85	2.471,04

Units		Square Miles	Square Centimeters	Square Meters	Hectares
1 square inch (sq.in.)	=	0.000,000,000,249,1	6.451,626	000,645,162,6	0.000,000,064,516
1 square foot (sq.ft.)	=	0.000,000,035,870,1	929,034.1	0.092,903,41	0.000,009,290,34
1 square yard (sq.yd.)	=	0.000,000,322,831	8,361,307	0.836,130,7	0.000,083,613,1
1 acre (acre)	=	0.001,562,5	40,468,726	4,046,873	0.404,687
1 square mile (sq.mi.)	=	1	25,899,984,703	2,589,998	258,999.8
1 square centimeter (cm.²)	=	0.000,000,000,038,610,6	1	0.000,1	0.000,000,01
1 square meter (m.²)	=	0.000,000,386,100,6	10,000	1	0.000,1
1 hectare (ha.)	=	0.003,861,006	100,000,000	10,000	1

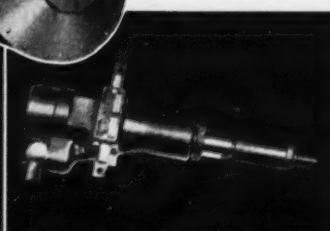


22 PROVEN DIESEL FEATURES

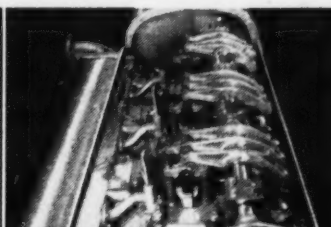
ONLY HENDY COMBINES THEM ALL



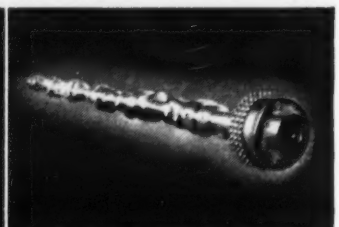
1. Oil-cooled pistons *increase piston-ring life.*



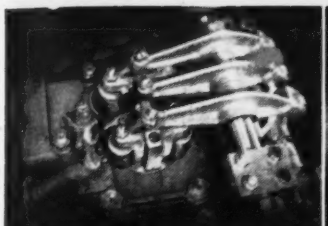
2. Unit fuel injectors *eliminate high-pressure lines.*



3. Dual valves *reduce valve maintenance.*



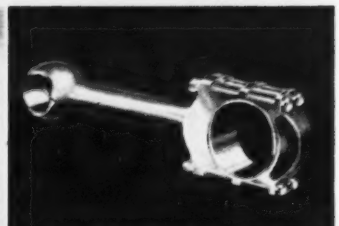
4. Overhead camshaft *eliminates push-rod linkages.*



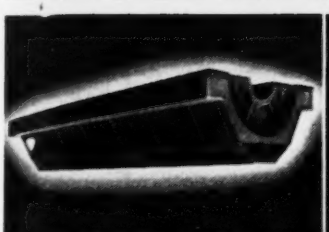
5. Hydraulic tappets *maintain correct clearances.*

6. Large-diameter crankshaft *for reliability.*

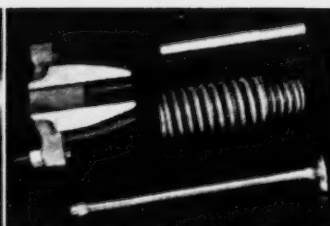
7. Simplified controls *aid easy operation.*



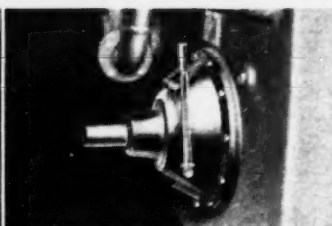
8. Large bearings in connecting rods *reduce maintenance.*



9. Welded steel bedplate *assures great rigidity.*



10. Positive valve mechanism *assures smooth action.*



11. Front-clutch power take off for auxiliaries.

OTHER FEATURES *not pictured here*

12. Removable main bearings
13. Double rear main bearings
14. Jet-action head cooling
15. Cage-type relief valves
16. Uniform-tension camshaft drive
17. Air-operated starting valve
18. Large-capacity cooling pumps
19. Mechanical or hydraulic governor
20. Water-cooled exhaust manifold
21. Fresh-water cooling
22. Full pressure lubrication

THE important fact about Hendy Diesels is that they combine, for the first time in a single engine, 22 of the most modern design features. Every one of these features was selected by Hendy engineers as a proven and practical development in Diesel design.

Only Hendy Diesels have all twenty-two! Examine the full list above—you are undoubtedly familiar with some—you'll want to know more about the others. Send for data available now on 6 or 8 cylinder Hendy Diesels from 350 to 675 hp, designed for a wide variety of industrial uses or with generators as complete electric plants.

JOSHUA HENDY IRON WORKS

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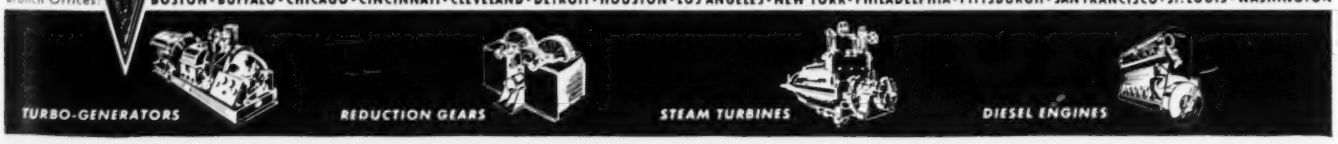
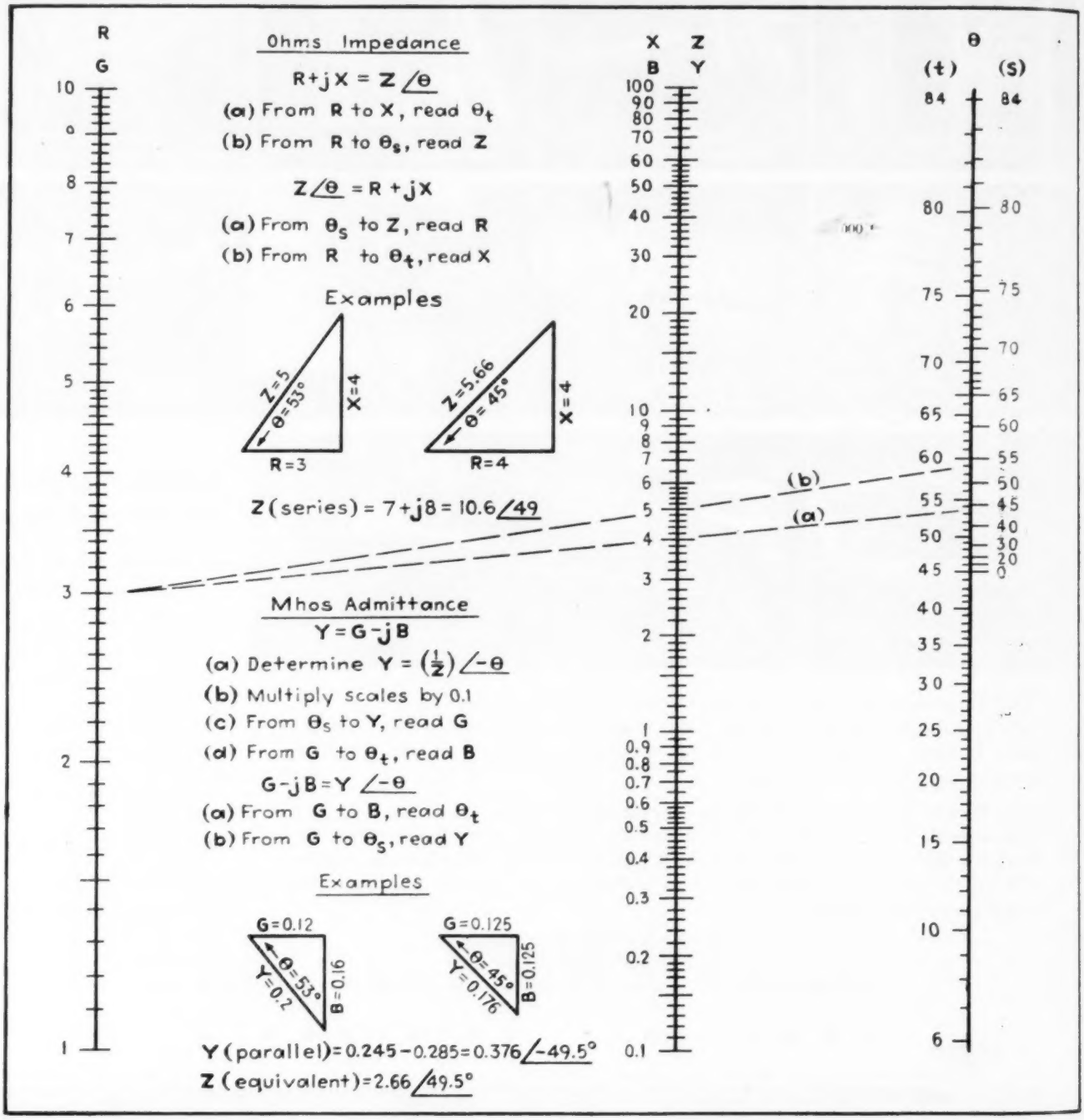


VECTOR TRIANGLES SOLVED BY NOMOGRAPH*—I

By W. W. EDSON, Head of Station Electrical Design, Boston Edison Co.

Chart provides a rapid means to solve triangles, such as to find the third side when the other two sides and an angle are given, or other such combinations. Although the examples refer to electrical circuits the application of the chart to stress diagrams, mechanical, navigation and other problems is obvious. Detailed electrical applications will be presented in a subsequent issue.



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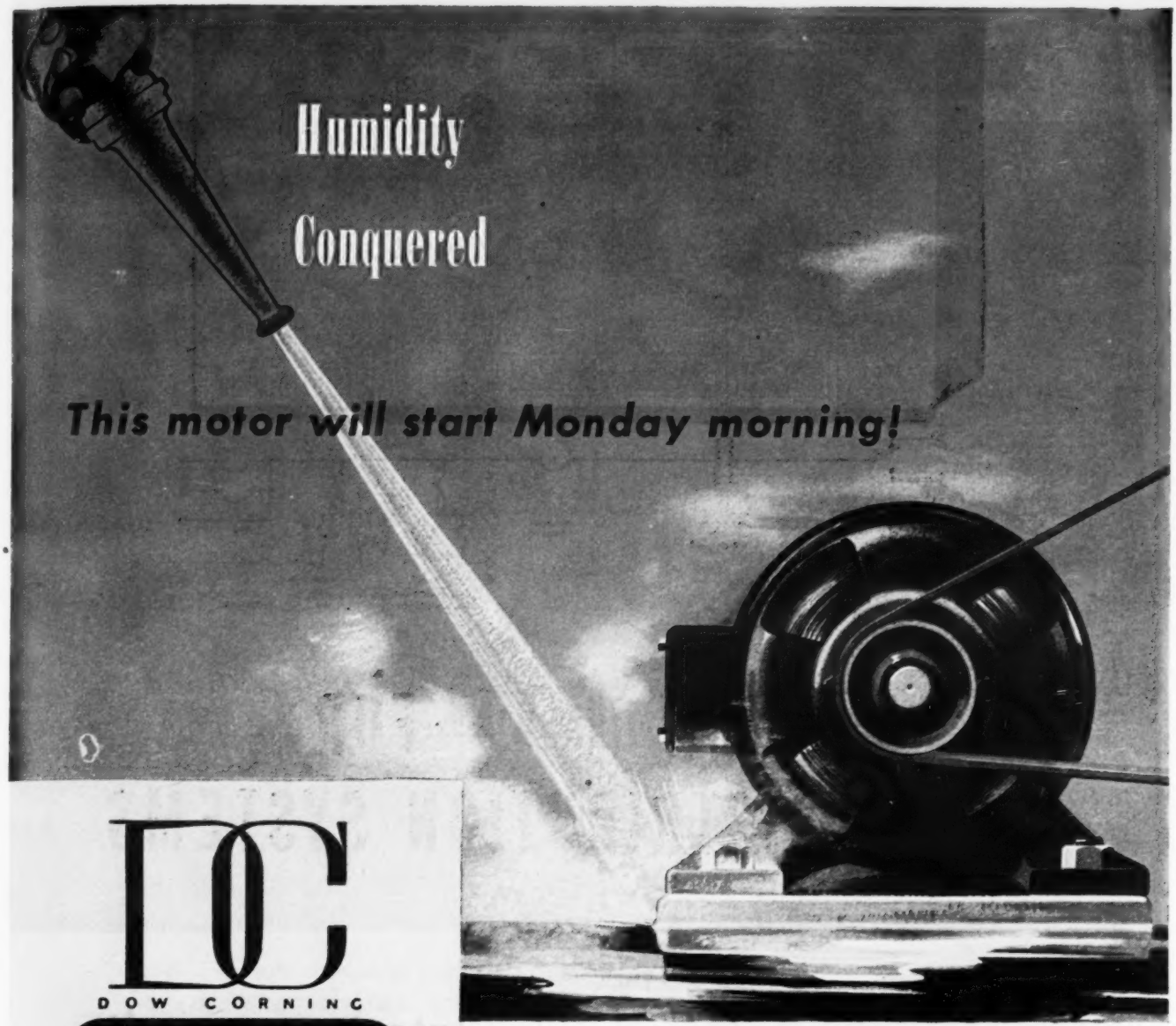

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VARNISHES

HIGH TEMPERATURE SILICONE INSULATION

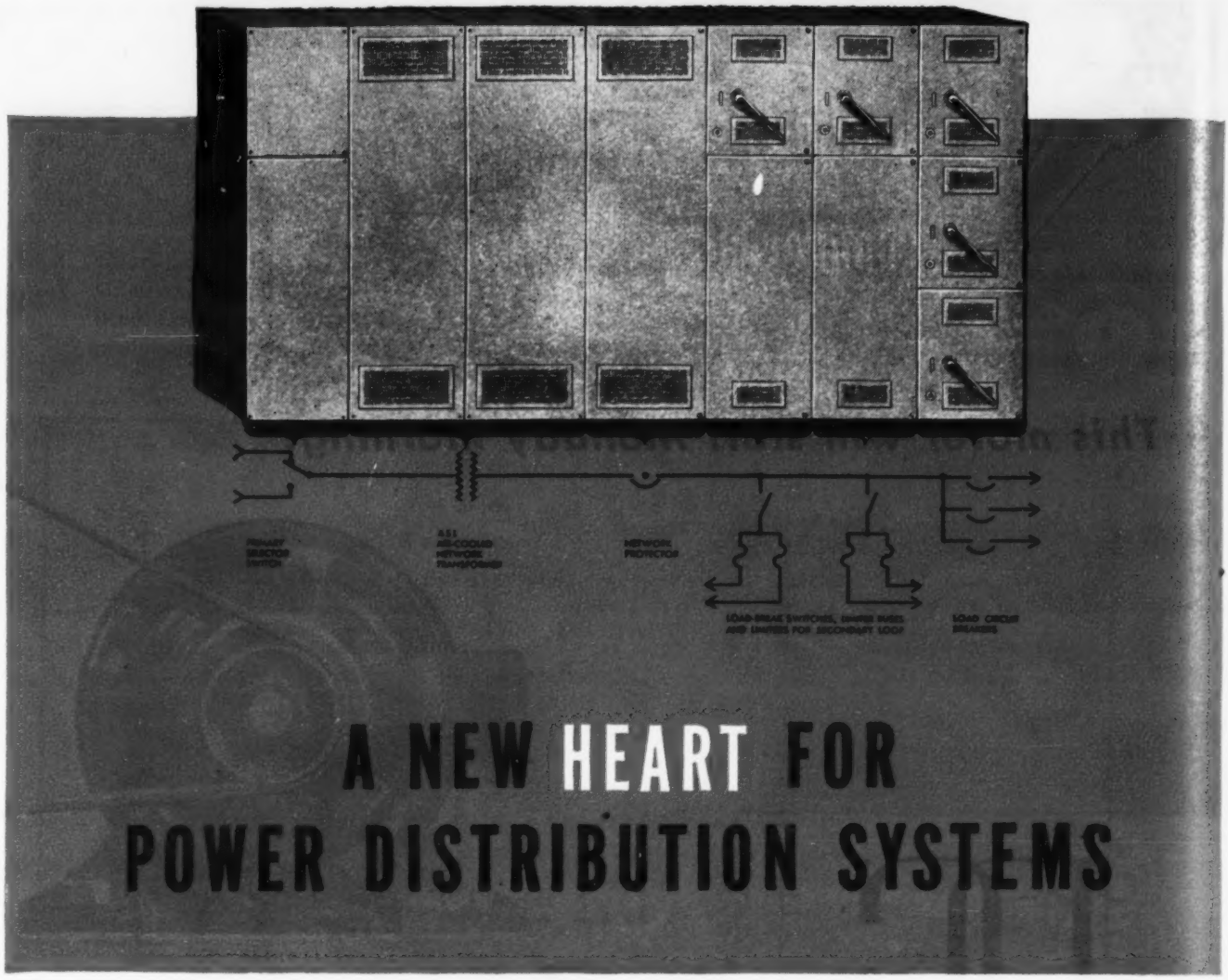
Humidity, the primary reason for failure of motors and other electrical equipment, is conquered by DC Silicone Varnishes. Even under extreme conditions of condensation, severe overloads or idleness in moist locations, DC insulated equipment starts and runs at full load.

High temperature silicone insulation was first made possible by DC Varnishes. These new heat stable resins are natural complements to the inorganic spacing materials—mica, Fiberglas and asbestos. Dow Corning Silicone Varnishes provide bonding and filling dielectrics which are highly resistant to heat, moisture, oil and chemicals.

DOW CORNING 993 . . . available in commercial quantities, is a heat curing, high temperature stable silicone varnish for impregnating motor stators, transformer coils and other electrical equipment; for varnishing Fiberglas or asbestos served wire; for varnishing Fiberglas and asbestos electrical insulating cloths, tapes, tying cords and sleeving; for bonding Fiberglas and mica combinations.

DOW CORNING CORPORATION
BOX 592, MIDLAND, MICHIGAN

Dow Corning



A NEW HEART FOR POWER DISTRIBUTION SYSTEMS

ordered—installed—operated as a unit

Here is a new heart for power distribution systems —the *Westinghouse Network Unit.* It saves time in ordering, installation and operation. It eliminates piecemeal assembly on the job! It can be installed anywhere indoors without a vault—because it is completely air-cooled. It can be installed in the immediate vicinity of working personnel with complete safety, or it can be placed overhead to save valuable floor space.

This flexibility results in substantial savings in materials and labor, and in service interruptions, with consequent production losses. It permits location of the Network Unit at or near the centers of load.

The Westinghouse Air-cooled Network Unit is only one item of the complete equipment Westinghouse can supply. Others are: control centers, power centers, switches, breakers, capacitors, protective devices, switchgear—in fact, all the equipment needed for any power distribution system. By ordering from *one* supplier, you place responsibility in *one* place . . . save time in ordering, installation and co-ordination for operation.

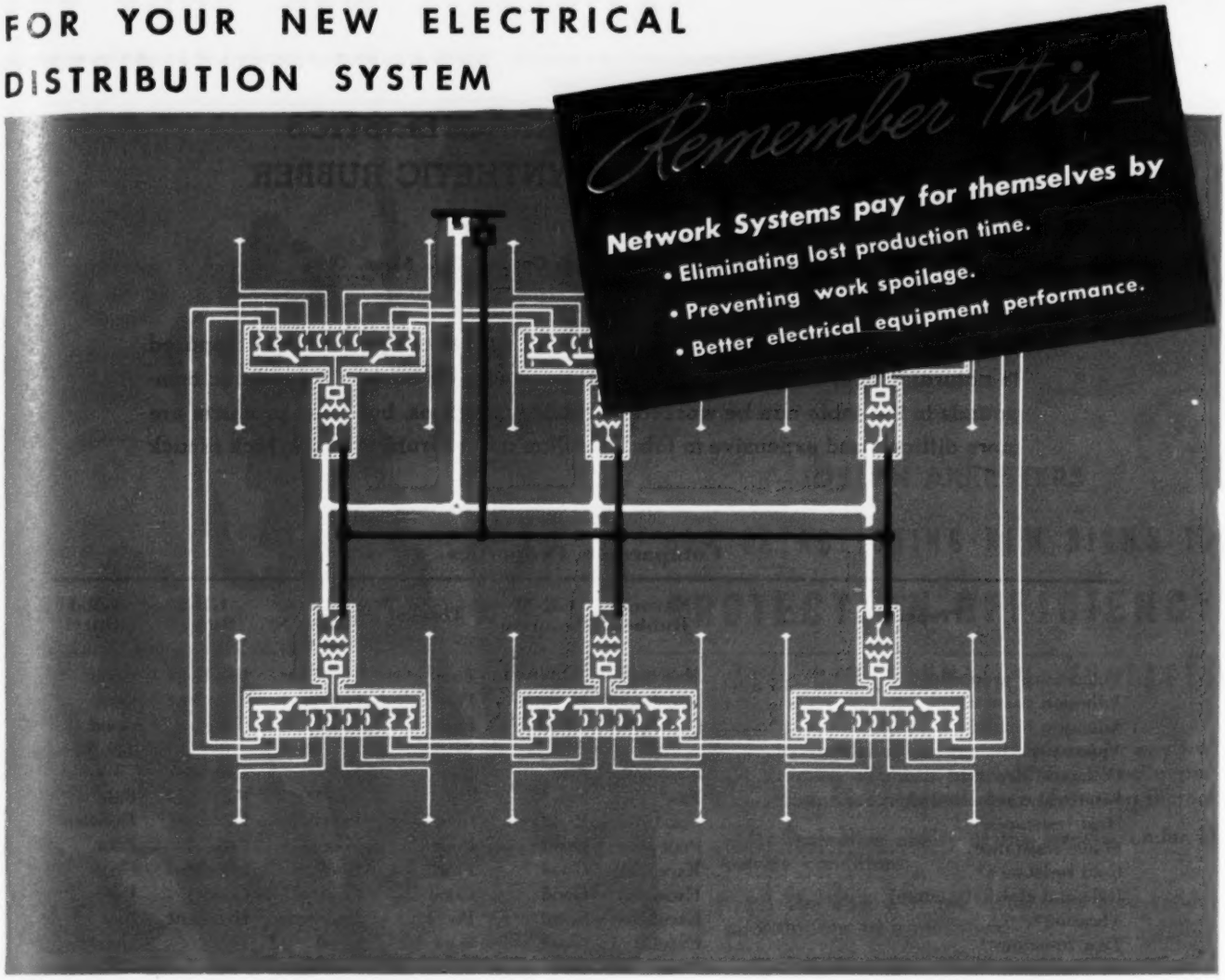
Complete specifications on all equipment are available to help you PLAN NOW for postwar construction. Phone your Westinghouse Office, or write Westinghouse Electric & Mfg. Co., P. O. Box 868, Pittsburgh 30, Pennsylvania. J-94642A

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

INDUSTRIAL

FOR YOUR NEW ELECTRICAL DISTRIBUTION SYSTEM


Remember this—
Network Systems pay for themselves by
• Eliminating lost production time.
• Preventing work spoilage.
• Better electrical equipment performance.

Since the first installation of Westinghouse industrial plant network systems (four years ago), we have been receiving comments like these:

- "because it assures uninterrupted service, we figure our network system has completely paid for itself by eliminating loss of production time caused by electric power interruptions."
- "light flicker has been entirely eliminated . . . improving working conditions and efficiency."
- "production has been increased because our motors are now getting the *right* voltage at *all* times . . . no longer any motor burnouts caused by undervoltage."
- "addition of new electrical facilities for critical work production was made in 50% less time . . . without disturbing any of the previous facilities."

We sincerely believe that wherever the highest degree of flexibility —reliability—and voltage regulation are "musts", the Westinghouse network system is best suited for tomorrow's profitable production of peacetime goods.

However, Westinghouse supplies all types of electrical distribution systems, and will recommend the one best suited to your needs.

Call your Westinghouse representative today for advice and *practical* help in laying out your postwar distribution system. It pays to blueprint now for tomorrow's needs.

PLANT DISTRIBUTION SYSTEMS

COMPARATIVE CHARACTERISTICS OF NATURAL AND SYNTHETIC RUBBER

Industrial Products Division, B. F. Goodrich Co., Akron, Ohio

Electrical and physical properties of synthetic rubber compounds are compared to natural rubber on an excellent, good, fair and poor basis. All synthetic compounds in the table can be worked on rubber machines, but some products are more difficult and expensive to fabricate than natural rubber due to lack of tack

Comparative Properties

Property	Natural Rubber	GR-M (Neoprene)	Thiokol	GR-A (Buna N)	GR-S (Buna S)	GR-I (Butyl)
Vulcanizing properties	Excellent	Excellent	Fair	Excellent	Excellent	Good
Adhesion to metals	Excellent	Excellent	Poor	Excellent	Excellent	Good
Adhesion to fabrics	Excellent	Excellent	Fair	Good	Good	Good
Approx. specific gravity basic material	0.93	1.23	1.34	1.00	0.94	0.92
Dielectric strength*	Excellent	Fair	Fair	Fair	Excellent	——
Electrical conductivity*	Fair	Fair**	Fair	Fair**	Fair	Fair
Heat resistance*	Good	Excellent	Poor	Excellent	Excellent	Excellent
Flame resistance	Poor	Good	Poor	Poor	Poor	Poor
Cold resistance*	Excellent	Good	Fair	Good	Excellent	Good
Rebound elasticity (snap)	Excellent	Good	Good	Fair	Good	Poor
Abrasion*	Excellent	Good	Poor	Excellent	Excellent	Fair
Tear resistance*	Excellent	Good	Poor	Good	Fair	Good
Abrasion resistance—soaked in oil	Poor	Fair	Poor	Excellent	Poor	Poor
Hardness Durometer A tests (100 is bone hard)	20 to 100	20 to 90	35 to 80	20 to 100	35 to 100	15 to 90
Resistance to aging	Good	Excellent	Excellent	Excellent	Excellent	Excellent
Resistance to swelling in lubricating oil	Poor	Good	Excellent	Excellent	Poor	Poor
Resistance to deterioration in oil	Poor	Excellent	Fair	Excellent	Poor	Good
Resistance to water absorption*	Fair	Good	Fair	Good	Good	Fair
Resistance to strong oxidizing agents	Poor	Poor	Poor	Poor	Poor	Good
Resistance to other corrosives	Good	Good	Good	Good	Good	Good
Resistance to sunlight*	Fair	Excellent	Excellent	Good	Fair	Excellent
Resistance to ozone*	Fair	Excellent	Excellent	Good	Fair	Excellent
Elongation	Excellent	Excellent	Fair	Excellent	Good	Excellent
Tensile strength*	Excellent	Good	Fair	Excellent	Good	Fair
Resistance to diffusion of petroleum products	Poor	Fair	Excellent	Excellent	Poor	Poor
Resistance to lacquer solvents	Poor	Poor	Good	Fair	Poor	Poor
Resistance to chlorinated hydrocarbons	Poor	Poor	Good	Good	Poor	Poor
Resistance to aromatic hydrocarbons (benzol, toluene, xylene, etc.)	Poor	Poor	Good	Fair	Poor	Fair
Gas diffusion	Fair	Good	Excellent	Good	Fair	Excellent
Workability	Excellent	Good	Fair	Good	Good	Good
Resistance to paint and ink dryers	Poor	Excellent	Excellent	Excellent	Excellent	Excellent
Color range	Good	Good	Poor	Good	Good	Good
Resistance to cold flow*	Excellent	Good	Poor	Excellent	Excellent	Fair

Properties marked with single asterisk (*) are available only in specific compounds. Double asterisk (**) denotes electrically conductive compounds with more "rubbery" characteristics that can be made of these synthetics than is the case with natural rubber, which has to be heavily "loaded" to attain the same degree of conductivity.

Following abbreviations are used in the column headings: GR-M—Government Rubber—Monovinylacetylene; GR-I—Government Rubber—Isobutylene; GR-A—Government Rubber—Acrylonitrile; and GR-S—Government Rubber—Styrene.

POSITIVE PROTECTION

JOSLYN ARRESTERS

ARE ESTABLISHING NEW HIGHS IN

PROTECTION-EFFICIENCY

ON ALL DISTRIBUTION VOLTAGES

• Lightning Arrester efficiency or any true figure of merit for lightning arrester performance must include the following factors:

(1) Protective ability of the arrester under all service conditions.

(2) The ability of the arrester to hold service interruptions to a minimum.

(3) The durability of the arrester in service.

The relative importance of these factors in the annual accounting of operating expense generally folllows the above order. Lightning arresters, deficient in any one of these factors, are expensive to have on a line from the standpoint of operating costs no matter how low their purchase price might be.

Fuse outages during thunderstorms not only cost money, cause customer inconvenience and add burden to already overtaxed manpower and service equipment, but they also indicate that *transformers and other equipment are being subjected to excessive voltages which may lead to ultimate failure.* Thus, storm fuse outage rates provide a convenient check on arrester efficiency.

One million Joslyn-Arrester-years of service provide statistical evidence of the superiority of Joslyn Arresters when compared with other arresters operating in the same regions. These records show conclusively that Joslyn Arresters are reducing operating costs through higher *protection-efficiency* even on the lowest primary distribution voltages.

JOSLYN MFG. and SUPPLY CO.

20 NORTH WACKER DRIVE — **CHICAGO 6, ILLINOIS**

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SOUTH EAST JOSLYN CO. Cincinnati 7, Ohio • Atlanta 3, Ga. • Cleveland 13, Ohio • Jacksonville, Fla. • Lexington, Ky.

JOSLYN SOUTHWEST CO. Dallas 1, Tex. • Houston 4, Tex.

SOUTHERN JOSLYN CO. New Orleans 19, La.

PAUL CARSON, Amarillo, Tex.

J. J. Costello, Boston 16, Mass.

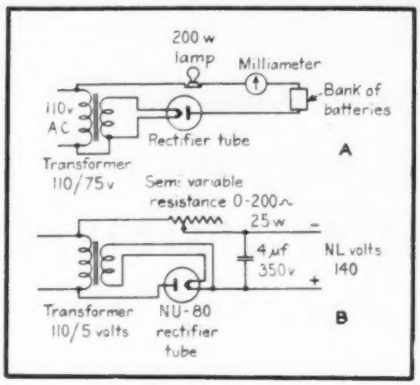
PAUL A. DOUDEN CO., Denver 2, Colo.

H. E. RANSFORD, Pittsburgh 22, Pa.

Simple Rectifier Recharges Dry Cells

A simple half-wave rectifier operating from 110-volt a.c. lighting potential is being successfully used at the meter department of the Central Illinois Electric & Gas Co., Rockford to recharge dry cell batteries used in meter reader's flashlights.

The circuit is a modification of a similar arrangement for rejuvenating dry cells first credited to the Pasadena, California, Police Department but subsequently used successfully by the Southern California Gas Co. and the Brooklyn Union Gas Co. The California practice was first reported in "Gas Age". Successful adaptation of the scheme by the Brooklyn Union Gas Co., was detailed in their house organ, "Brooklyn Union News" with the statement that recharging had reduced the company's purchases of new batteries by 67 percent; a reduction of considerable significance in view of the current wartime shortage of dry cells.



HALF-WAVE rectifier circuits used to rejuvenate dry cell batteries and in meter reader's flashlights. Circuit "A" is used by Pasadena Police and others. Circuit "B" is modification of same circuit used by Illinois utility

Brooklyn Union Gas Co. used the scheme to re-charge 50 or more cells at a time by passing 150 milliamperes of direct current at 75 volts through the cells connected in series for a period of six hours.

The Rockford company's adaptation of the circuit is somewhat different in circuit details from the others. In this case direct current of approximately 100 milliamperes at 115 volts is put through 25 cells at a time for a period of about four or five hours. For convenience the cells to be charged are inserted in length of conduit of appropriate length and diameter with the positive and negative battery terminals brought out through pipe caps to binding posts on the rectifier set.

Meter men report that they are able to use original dry cells about three times before they must be scrapped. Some of them claim that the recharged cells are "better" than the new ones; this is questionable. It is true, however, that the scheme has resulted in stretching the life of dry cells an estimated 250-300 percent at a time when the supply is none too plentiful.

After the cells are charged a three-hour rest period is required. Current and voltage of the cells is then measured. Those showing a discharge of less than 2 amp. or under 1.5 volts are rejected or a second attempt to recharge is made. According to A. H. Petit of the Rockford company, the shelf life of a recharged cell is quite short. Effort is made to see that there are not too many recharged cells on hand at any time.

In operating the charger, the semi-variable resistor is adjusted according to the number of cells being charged at one time. When the full 25 cells are charged the resistor is jumped out of the circuit.

•

How to Protect Metering Equipment

II—High-Voltage Metering—Industrial*

By R. F. QUINN*
Central Station Engineering Division
General Electric Co., Schenectady, N. Y.

While most high-voltage metering equipment is located in a substation, there is occasionally a high-voltage metering equipment installation on an exposed line and located one or two poles away from a consumer's substation. For such installations, adequate lightning arresters should be installed at the metering location. These should be connected from the line side terminals of the instrument transformer to a reliable low resistance ground with the instrument transformer cases and grounded side of current transformer secondaries interconnected with this same ground. Bypass protectors should be connected across the primary windings of the current transformers. See Article I of this series.

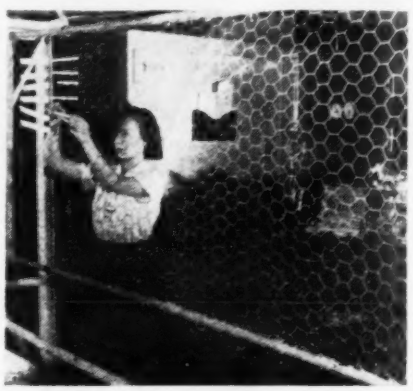
Occasionally, it is necessary to run long secondary conductors from a current transformer to a switchboard with proportionately greater possibility of the secondary circuit being inadvertently opened and thereby developing a high secondary voltage. For such situations there is a protector which shunts the current transformer secondary. In the event that the secondary becomes open-circuited, the resistance material starts to heat up and at a certain temperature, the thermostat closes a switch which short circuits the current transformer.

* Second of a series of articles that began in the ELECTRICAL WORLD January 20, page 133.

•

Chicken-Wire Plating Rack Has Advantages

Chicken wire racks are today saving man-hours in the handling of small aircraft parts for plating operators. It has been estimated that by its use the loading time in this operation has been cut in half. In loading, parts are placed on the rack by slipping the ends through the wire mesh where they are held in place by the natural pressure of the wire.



OPERATOR LOADING small parts in new type plating rack

Parts which are not adaptable to this procedure can be hung on the rack with small hooks. The latter method was the one previously used and that time would be saved by the use of the former is obvious.

A second advantage is that the base to be plated always faces the anode, thus assuring uniformity of deposit and thereby cutting down on rejects due to uneven coating. Another advantage is that it provides a safe, efficient means for draining parts as they are removed from the baths while protecting the operator's hands

ROME SYNTHINOL*

Standard colors are Black, White, Red, Green, Yellow, Blue, Orange and Brown.

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- ✓ ABRASION RESISTANCE
- ✓ FLAME RESISTANCE
- ✓ HIGH INSULATION RESISTANCE
- ✓ COLOR STABILITY
- ✓ WATER RESISTANCE
- ✓ ACID RESISTANCE
- ✓ SOLVENT RESISTANCE
- ✓ TENSILE STRENGTH
- ✓ FLEXURAL STRENGTH
- ✓ TOUGHNESS (impact strength)

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C-W
Air Break
SWITCHES

protect your service under the most severe operating conditions

● Top illustration shows the hinge end of a C-W Switch made during an ice test. The switch was warm, approximately 70°, when the spray was started and the ice deposit represents a six hour accumulation. A gradually applied pull of 60 lbs. on a 28 inch lever cracked the ice at the hubs of the cranks and freed the mechanism.

The lower picture shows the switch closed into contact through a heavy deposit of clear ice. The switch was closed at the speed of motor operation. This contact housing is not only a sleet hood but is also designed for ice breaking.

For dependable protection specify Hi-Voltage Air Break Switches.

HI-VOLTAGE
EQUIPMENT COMPANY
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and clothing from the caustic solutions.

Basic design of the rack consists of a tubular metal frame work across which wire mesh is stretched. Some of the frames are covered with chicken wire and others with a larger mesh material to accommodate various size parts.

When the rack is loaded, it is picked up by the top bar with an overhead conveyor and carried to the plating bath where it is tilted to either side to insure complete drainage, and then carried to the point where the plated parts are unloaded. Throughout the whole operation, it is unnecessary for the operator's hands or clothes to come in contact with the plating solution at any time.

The Glenn L. Martin Co. is using these racks; they were developed by Frank Rohr of the finishing and plating department.

•

L-V. Circuit Breakers, Interrupting Capacity

By WILLIAM DEANS,
Chief Engineer, I-T-E Circuit Breaker Co., Philadelphia, Pa.

With practical assumptions and the development of two charts, interrupting capacity can be calculated for determining the proper applications of low-voltage circuit breakers.

Motor loads have a bearing on interrupting capacity. Modern air circuit breakers open quickly and on a short circuit energy flows from the motors into the fault. The short-circuit current is the total of the current from the normal source plus that from all connected motors operating temporarily as generators.

Impedance of the circuit may be conservatively considered wholly reactance since usually the latter is high compared with the resistance. In this treatment, only the reactance is used in computing the short circuit current and it is expressed in percent, based upon rated transformer kva.

A reactance (or resistance) known in ohms may be converted to percent or per unit value as follows:

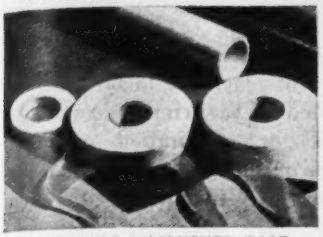
$$X \text{ (percent)} = \frac{100{,}000 \times \text{base kva.}}{\text{volts}^2}$$

$$X \text{ (per unit)} = \frac{1{,}000 \times \text{base kva.}}{\text{volts}^2}$$

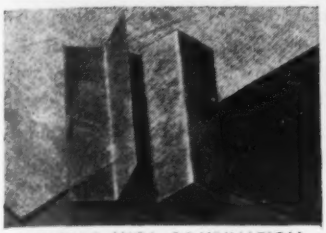
and X (percent) $= 100 \times X$ (per unit)

The charts are drawn for reactance expressed in percent with transformer rated kva. as base. They may be used

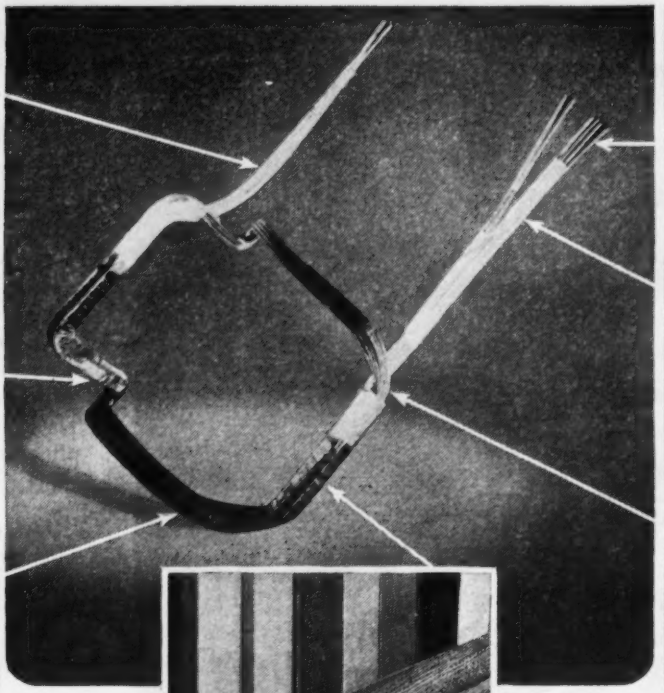
FIBERGLAS BRAIDED SLEEVING



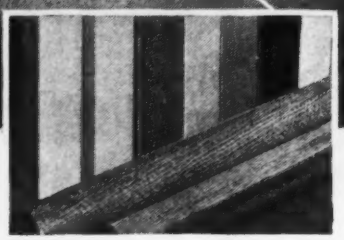
FIBERGLAS VARNISHED TAPE



FIBERGLAS MICA COMBINATION

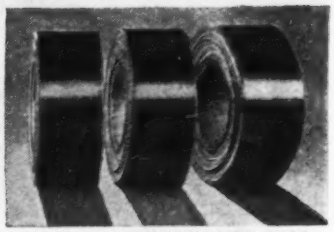


LAMINATES



FIBERGLAS INSULATED WIRE

FIBERGLAS TAPE



FIBERGLAS IMPREGNATED TAPE

A motor's best friend is its insulation!

The design skill and manufacturing excellence which go into most motors are frequently dissipated or completely wasted due to changes in operating conditions, the human element or other external causes of motor failure. Nationwide surveys show that motor insulation failures impose a tremendous time loss and cost burden on every industry.

In countless case histories it has been proved that Fiberglas Electrical Insulation Material provides the extra protection and stamina which is successfully overcoming many of the unanticipated causes of motor failure.

Fiberglas is glass in fiber form—as such, it retains part of the characteristics commonly associated with glass. And, because of its form, fibers finer than human hair, it gains several desirable characteristics which make it an unsurpassed insulating material when properly impregnated. In textile form Fiberglas provides a thin, strong, flexible, inorganic fabric base for insulating impregnants. This combination has unexcelled advantages and characteristics, and is available in Magnet Wire, Lead Wire, Special Wires and Cables, Varnished Cloth and Tape, Mica Combinations, Laminates, Saturated Sleeving, Varnished Tubing, Pressure-Sensitive Tapes and special products.

Anyone concerned with the specification or application of electrical insulation should have a copy of the new Fiberglas Electrical Insulation Material Catalog for ready reference . . . it tells what type to use, where and how. Write for your copy today and ask for the name of the Fiberglas Electrical Insulation Material supplier nearest to you . . . *Owens-Corning Fiberglas Corp., 1858 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*

FIBERGLAS combats these common enemies

Fiberglas provides all of the advantages of an inorganic material yet it has high tensile strength and an unusually favorable space factor.

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Here's another reason why *one man* gets smooth, precise bends quickly with a GREENLEE Bender—in pipe up to 4½", rigid and thin-wall conduit, tubing, bus bars.

For speedy withdrawal or to move pipe for second bend, simply force down operating lever to lowest position, releasing pressure. Then transfer handle to quick-positioning lever for withdrawal of ram and release of pipe—immediately!

This is just one of the many specially-engineered "short cuts" to make bending as simple as A.B.C. with a GREENLEE... for important labor and material savings on every bending job, large or small.

Get all the facts on complete line of GREENLEE Benders, and other time-saving tools for electrical workers. Write today for your free copy of Catalog 33E. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1802 Columbia Avenue, Rockford, Illinois.

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directly for per-unit values simply by shifting the decimal point two places to the left on the chart, in the reactance scale.

Basic equation of the charts is:

$$I_{IC} = 1.25\left(\frac{100{,}000 \times \text{kva.}}{X_{PC} \times E \times \sqrt{3}} + I_M\right)$$

where I_{IC} = Interrupting capacity in amperes
Kva. = Transformer rating
X_{PC} = Reactance in percent
E = Volts
I_M = Current from motors

Values of reactance to be used are determined by a primary supply of unlimited or of limited capacity. These are outlined below and their applications are included with each chart.

1. Unlimited Primary Supply—This means that the capacity of the primary supply is so great that a short circuit at the secondary terminals of the transformer does not appreciably lower the voltage at the primary terminals of the transformer. This is the most conservative assumption.

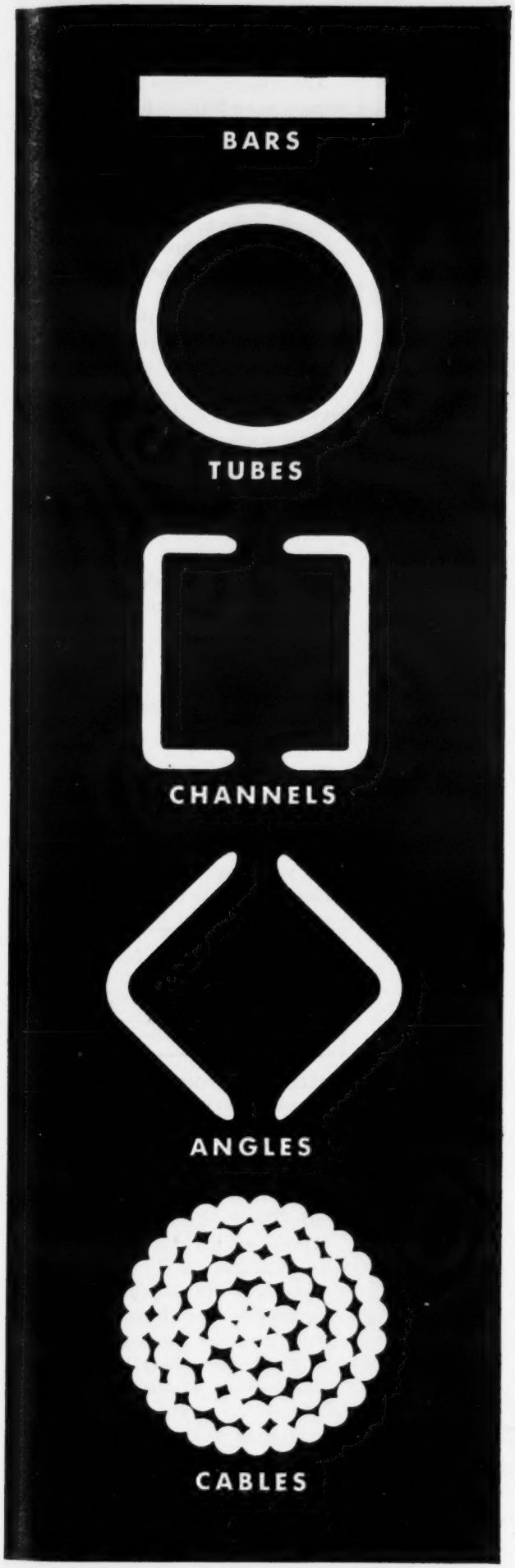
2. Limited Primary Supply—Either of the charts may be used for this condition with proper value of reactance. To determine that reactance, it is necessary to know the kva. the primary supply is capable of delivering into a short circuit at the primary terminals of the transformer —that is the short-circuit kva. of the primary supply at that point. (This may require analysis of the whole primary system.) Where this information is not available, it may be approximated from the kva. interrupting rating of the power circuit breaker in the primary supply.

The charts for determining the interrupting capacity of low voltage air circuit breakers in three-phase circuits will be presented in subsequent issues of this publication.

•

Outages Reduced by Moving Transformer

System grounding transformer bank was removed from the main substation yard and placed in a vault in the station to remove outage possibilities. The transformer was located directly beneath the 6.9 and 33-kv. buses. Clearances above the transformer for these buses were 12 and 27 ft. respectively. In its new position it will be encased in a concrete vault and connected to the station bus instead of the yard bus.



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To these advantages may be added such further qualifications as high thermal conductivity, high strength, high resistance to corrosion and ready availability of accessory equipment. Wherever modern electrical engineering practice dictates bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the wide range of *copper bus shapes made by The American Brass Company will meet every requirement.*

In addition to a complete line of copper bus bars of rectangular shapes, this Company makes high conductivity pipe and tube, stranded cables and many special shapes.

Of particular interest to electrical engineers are the ventilated busses made from channels, angles, tubes and rectangular copper bars. Information, including our Bus Conductor Booklet, C-25, and the suggestions of our Technical Department on various bus conductors and assemblies, is available on request. 44109

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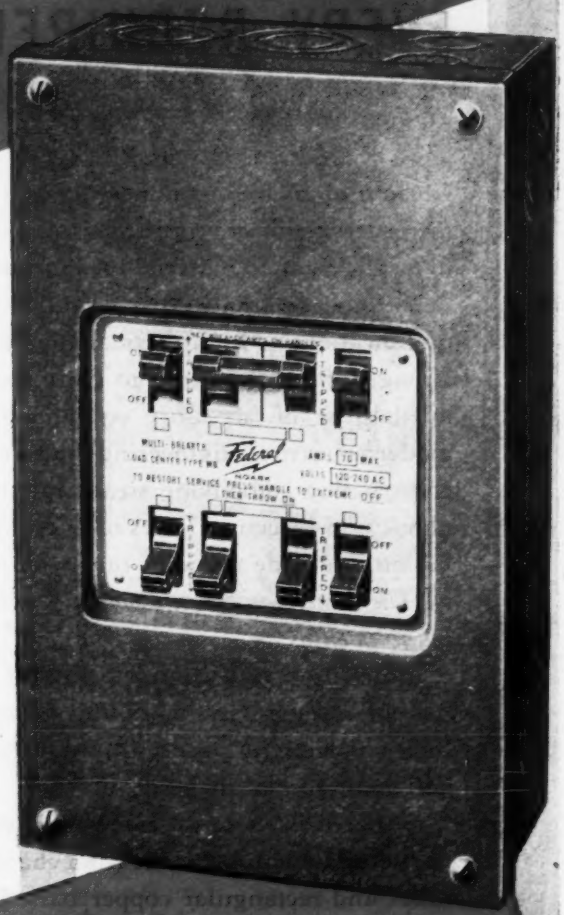

They stand OUT and UP under every condition—for FEDERAL MULTI-BREAKERS have been designed to meet and surpass the most exacting requirements. That's why leading engineers and architects the country over are replacing fuse equipment and other circuit breakers with FEDERAL MULTI-BREAKERS.

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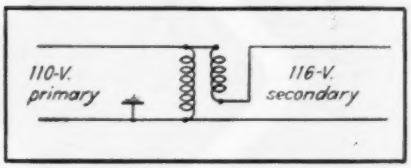
through oil circuit breaker and disconnecting switches.

The repositioning of the transformer according to the above mentioned plan devised by Edward Lamberson, Supt. of Production, Staten Island Edison Corp., Staten Island, N. Y., resulted from an interruption due to the transformer failure. The oil thrown out became ignited and it is believed that the combination of the fire and the ionized arc path was the cause of the buses arcing over. Several insulators were completely destroyed and leads to a pothead were burned off. As a result 28,000-kw. load was dropped and substation was out of service for approximately three hours. One of the turbines in low pressure plant was started immediately and load was picked up on 6,900 volt system, in 30 minutes. This gave power to shipyards on the north shore. The new arrangement will circumvent such possibilities.

•

Bell Transformer Cuts Light Complaints

Utilities have received an occasional complaint from a customer that his fluorescent desk lamp has a habit of going out when the refrigerator starts up. To correct this condition for an isolated customer by distribution reinforcement is usually considered too costly for the benefits derived.



BELL TRANSFORMER connected as booster transformer eliminates complaints due to fluorescent lamp blackout

However, the Patchogue Electric Co., Patchogue, L. I., N. Y. found a convenient and cheap remedy for this trouble. Confronted by an insistent customer whose voltage at the end of the line was 110 on the 115-volt secondary system, W. S. Oxley, engineer, connected a standard bell transformer as a booster transformer in the light cord at the desk. The lamp has since behaved to the customer's satisfaction. The 6-volt boost proved sufficient to override the refrigerator dip.

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For Those Hot-Spot Installations You'd Like to Forget

ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA)

This cable and Rockbestos A.V.C. Motor Lead Cable have a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

1. A tough rugged asbestos braid, resistant to heat, flame, moisture, oil, grease or corrosive fumes.

2. Outer felted asbestos wall, impregnated with heat, flame, and moisture resistant compounds, serves as an effectiv barrier against high ambient temperatures and flame.

3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.

4. Felted asbestos insulation, also impregnated with heat, flame and moisture resisting compounds, withstands conductor-heating overloads and won't dry out, bake brittle, flow or burn.

5. The conductor is perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

WON'T bake brittle, bloom, burn or rot.
RESISTS moisture, oil, grease and fumes.

ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors. Standard stranding AWG No. 12—19/No. 25 and No. 9—19/No. 22. Other sizes and strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

THERMOSTAT CONTROL WIRE — TABLE TC

Sizes No. 14, 16 and 18 AWG in two to six conductors with 12½, 25 or 31 mil wall of felted asbestos insulation and cadmium plated steel armor.

A multi-conductor control wire for low voltage intercommunicating, signal and temperature control systems. Its life time insulation and rugged steel armor will give you troubleproof circuits.

The way to wipe out wire-worries is to install Rockbestos A.V.C. in all those hot-spots that are likely to cause trouble . . . soaking pits, forging presses, steam tunnels, lehrs, kilns, furnaces, boiler rooms, etc. With Rockbestos A.V.C. circuits you can depend on trouble-free service year after year, thus saving the time and money required by frequent rewiring jobs.

Rockbestos A.V.C. has a *permanent impregnated asbestos insulation* which stands up in operating temperatures up to 230° F. without baking or cracking. It resists heat, flame, oil, grease, moisture and corrosive fumes . . . won't bloom, flow, swell or rot under exposure to severe heat and vibration.

Rockbestos A.V.C. is available in many standard constructions for service requirements ranging from 600 to 5000 volts. When ordering or inquiring, please furnish CMP allotment symbol and certification. For complete information and samples, write nearest branch office or:

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LOAD SERVICING

Commercial
Industrial

Residential
Rural

Equipping Power Saws for Mass Production

In a rush building job to serve an army camp on a utility system in the East, straight-line factory production methods were used to great advantage in pre-cutting wooden structural members. The heart of the job was a carpenter shop where four 5-hp. induction motor-driven circular saws of the DeWalt type were lined up about 12 to 15 ft. apart above a bench, the machines being set to perform one operation each. Stock entered the shop through an opening at the beginning of the cutting line, pausing only for each machine to complete its pre-arranged function. With four machines, four operators and six helpers, 300 2-in. by 6-in. by 20-ft. rafters were completed ready for erection per hr. Other four-operation members were cut with like efficiency. A time study showed that by hand methods only it would require 50 mechanics to achieve the above rate of production, making the savings by electrically driven saws about $53 per hr.

On a two-machine line producing stair stringers fifteen 14-rise and 15-tread stringers per hr. were turned out by only two operators and no laborers, compared with a former rate of one stringer per man per hr. The saving over hand methods was $16.25 per hr.

Electrical equipment used in this way minimized stock handling, eliminated layout work, and increased accuracy of output. On the camp job as a whole the dependability, versatility and safety of electric service made it feasible to pre-cut sufficient stock on only 13 machines to keep a small army of carpenters busy in erection under centralized control of lumber cutting and allocation.

FOUR 5-HP. CIRCULAR SAWS in production line turned out 300 rafters per hr. in erecting wooden buildings at a U. S. Army camp

Electric Heat Gives Quality Control

In the laboratory of the Seymour Mfg. Co., (Conn.) a 3-kw., 220-volt, single-phase, Ajax high-frequency, 50,000-cycle melting furnace has been utilized for the past eight years to control accurately the manufacture of high-grade nickel anodes. Test pieces of pure nickel are cast in this furnace, the charges weighing about 2.5 lb. each. The furnace provides a maximum temperature of about 3,100 deg. F., and its use enables the company better to govern the molding and casting techniques in the large production furnaces of the main casting shop. Only nominal replacements have been required during this period, such as a few spark gaps and refractories. Power service is furnished by the Connecticut Light & Power Co.

LABORATORY FURNACE helps maintain quality of products for eight years in high-grade nickel anode plant

Competitive Outlook for Liquefied Gas*

BY J. P. McELROY

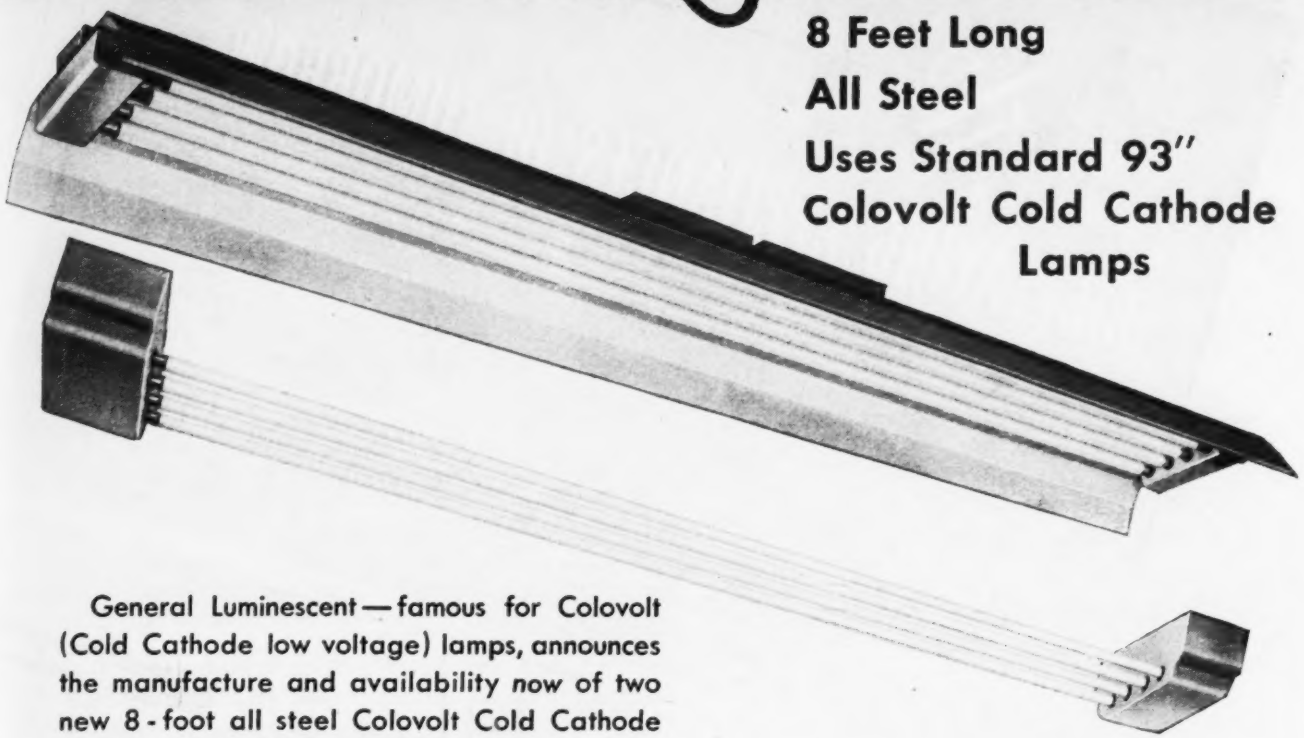
Pacific Gas & Electric Co., Fresno, Calif.

Liquefied petroleum gas today is a substantial competitor of the electric utilities for the consumer dollar. The marketed production of liquefied gas shows an uninterrupted rapid growth unaffected by the war. Domestic consumption represents more than half of the total distribution. Liquefied petroleum gas is derived from natural oil well gas or oil refining. Its availability in the immediate post-war

* Part of a presentation before Fall Conference, Pacific Coast Electrical Association, San Francisco.

Now! *COLOVOLT

COLD CATHODE FIXTURES



8 Feet Long
All Steel
Uses Standard 93″ Colovolt Cold Cathode Lamps

General Luminescent — famous for Colovolt (Cold Cathode low voltage) lamps, announces the manufacture and availability *now* of two new 8-foot all steel Colovolt Cold Cathode lighting fixtures for commercial and industrial applications in a standard "packaged" unit.

Both of these fixtures use standard 93" Colovolt 10,000 hour lamps and can be used singly or in continuous line lighting in multiples of 8 feet. Instantaneous starting, no flickering, guaranteed for 1 year except for failure due to breakage, and the fact that the long life expectancy of Colovolt lamps may be realized even when constantly turned on and off, are additional advantages.

Contact your electrical wholesaler or jobber or write us for full details.

Above

INDUSTRIAL UNIT— The Industrial Fixture, designed to give the maximum of lighting efficiency has an all-steel 8-foot baked white enamel reflector which is easily removed for cleaning. Four lamp fixture delivers 8800 lumens. Also available in a two-lamp fixture.

Below

SIMPLICITY UNIT— The "Simplicity" Lighting Unit for commercial uses is distinctive in design, easy to install and simple to maintain. This 4-lamp fixture delivers 8800 lumens.

* Trade Mark registered U. S. Pat. Off.

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Rural

Equipping Power Saws for Mass Production

In a rush building job to serve an army camp on a utility system in the East, straight-line factory production methods were used to great advantage in pre-cutting wooden structural members. The heart of the job was a carpenter shop where four 5-hp. induction motor-driven circular saws of the DeWalt type were lined up about 12 to 15 ft. apart above a bench, the machines being set to perform one operation each. Stock entered the shop through an opening at the beginning of the cutting line, pausing only for each machine to complete its pre-arranged function. With four machines, four operators and six helpers, 300 2-in. by 6-in. by 20-ft. rafters were completed ready for erection per hr. Other four-operation members were cut with like efficiency. A time study showed that by hand methods only it would require 50 mechanics to achieve the above rate of production, making the savings by electrically driven saws about $53 per hr.

On a two-machine line producing stair stringers fifteen 14-rise and 15-tread stringers per hr. were turned out by only two operators and no laborers, compared with a former rate of one stringer per man per hr. The saving over hand methods was $16.25 per hr.

Electrical equipment used in this way minimized stock handling, eliminated layout work, and increased accuracy of output. On the camp job as a whole the dependability, versatility and safety of electric service made it feasible to pre-cut sufficient stock on only 13 machines to keep a small army of carpenters busy in erection under centralized control of lumber cutting and allocation.

FOUR 5-HP. CIRCULAR SAWS in production line turned out 300 rafters per hr. in erecting wooden buildings at a U. S. Army camp

Electric Heat Gives Quality Control

In the laboratory of the Seymour Mfg. Co., (Conn.) a 3-kw., 220-volt, single-phase, Ajax high-frequency, 50,000-cycle melting furnace has been utilized for the past eight years to control accurately the manufacture of high-grade nickel anodes. Test pieces of pure nickel are cast in this furnace, the charges weighing about 2.5 lb. each. The furnace provides a maximum temperature of about 3,100 deg. F., and its use enables the company better to govern the molding and casting techniques in the large production furnaces of the main casting

LABORATORY FURNACE helps maintain quality of products for eight years in high-grade nickel anode plant

shop. Only nominal replacements have been required during this period, such as a few spark gaps and refractories. Power service is furnished by the Connecticut Light & Power Co.

•

Competitive Outlook for Liquefied Gas*

BY J. P. McELROY

Pacific Gas & Electric Co., Fresno, Calif.

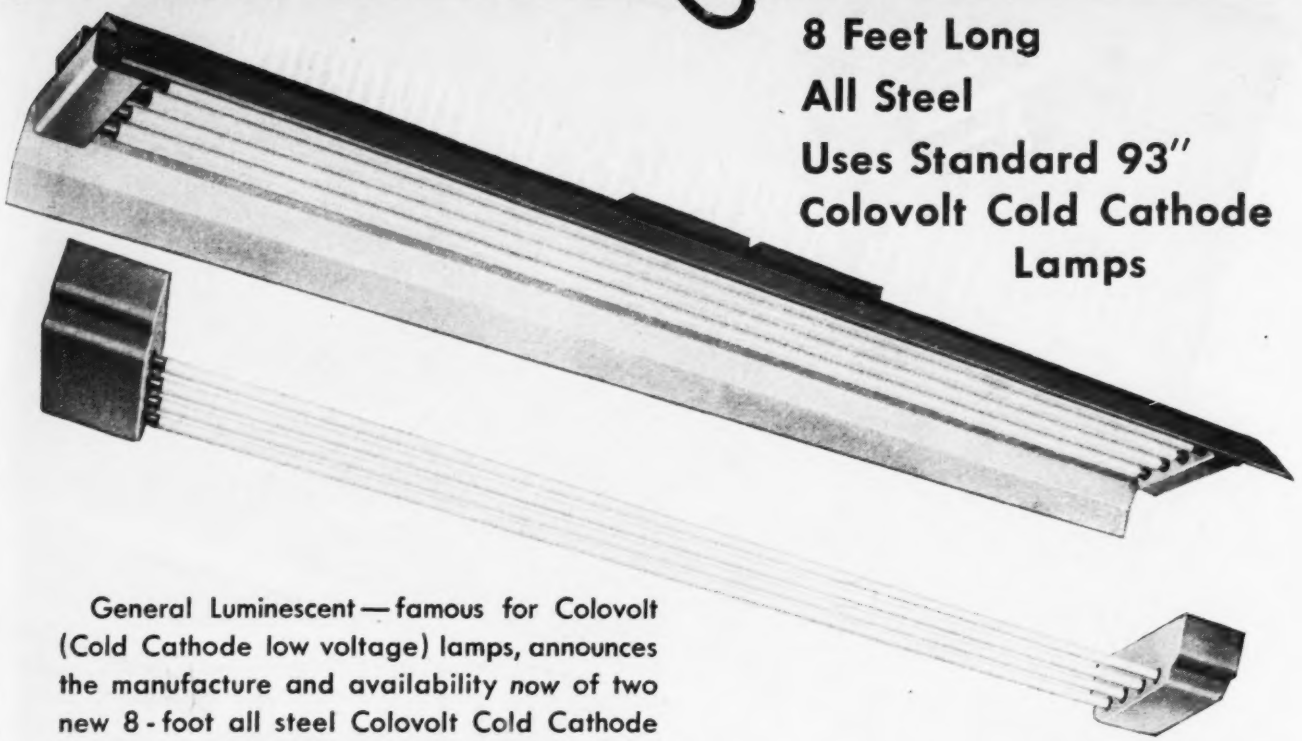
Liquefied petroleum gas today is a substantial competitor of the electric utilities for the consumer dollar. The marketed production of liquefied gas shows an uninterrupted rapid growth unaffected by the war. Domestic consumption represents more than half of the total distribution. Liquefied petroleum gas is derived from natural oil well gas or oil refining. Its availability in the immediate post-war

* Part of a presentation before Fall Conclave, Pacific Coast Electrical Association, San Francisco.

Now!

COLOVOLT*

COLD CATHODE FIXTURES



8 Feet Long
All Steel
Uses Standard 93″ Colovolt Cold Cathode Lamps

General Luminescent — famous for Colovolt (Cold Cathode low voltage) lamps, announces the manufacture and availability *now* of two new 8-foot all steel Colovolt Cold Cathode lighting fixtures for commercial and industrial applications in a standard "packaged" unit.

Both of these fixtures use standard 93" Colovolt 10,000 hour lamps and can be used singly or in continuous line lighting in multiples of 8 feet. Instantaneous starting, no flickering, guaranteed for 1 year except for failure due to breakage, and the fact that the long life expectancy of Colovolt lamps may be realized even when constantly turned on and off, are additional advantages.

Contact your electrical wholesaler or jobber or write us for full details.

Above

INDUSTRIAL UNIT— The Industrial Fixture, designed to give the maximum of lighting efficiency has an all-steel 8-foot baked white enamel reflector which is easily removed for cleaning. Four lamp fixture delivers 8800 lumens. Also available in a two-lamp fixture.

Below

SIMPLICITY UNIT— The "Simplicity" Lighting Unit for commercial uses is distinctive in design, easy to install and simple to maintain. This 4-lamp fixture delivers 8800 lumens.

* Trade Mark registered U. S. Pat. Off.

GENERAL LUMINESCENT CORPORATION

660 SOUTH FEDERAL STREET • CHICAGO 5, ILLINOIS

WORKING BLUEPRINTS
ELECTRIC KITCHEN DESIGNS
DISPLAYING APPLIANCES OF TOMORROW
BY
STORE FRONT DESIGNS
APPLIANCE STORE FLOOR LAYOUTS
DEPARTMENT STORE FLOOR LAYOUTS
BACKGROUND DISPLAYS

NEW IDEAS FOR POSTWAR APPLIANCE DEPARTMENTS

Kelvinator Issues a Great New Portfolio of Practical Designs and Plans for Postwar Appliance Display

Kelvinator Retailers will receive unusual co-operation from Kelvinator in re-designing the postwar layouts of their appliance departments in the form of a new portfolio, "Displaying Appliances of Tomorrow." Filled cover to cover with new and practical ideas, it is a working guide, complete with blueprints, for making appliance departments more attractive and more efficient selling centers in the postwar years.

The result of months of study by architects, display and merchandising men, "Displaying Appliances of Tomorrow" contains practical, usable ideas for various types of store layouts. The department and furniture store will find six distinctly different display modes with the variations necessary for adapting them from single bay to 6 bay space.

The specialty appliance dealer will find full and complete store layouts—involving the techniques of proper display for record, radio, small appliance departments, as well as major appliance departments. The designs include not only interior but also exterior store front designs, together with practical ideas for remodeling present showcases to fit in with the new store motif.

And each department layout and each display idea is designed not for show, but for the fundamentals of building traffic and making selling within the store more efficient through better display and arrangement.

Here is another example of what Kelvinator means by "Retail-Minded" action . . . another example of how the Kelvinator Franchise is designed to build, for those who hold it, a long-term, highly profitable business.

LOOK AHEAD WITH Kelvinator

TUNE IN: A New Radio Hit Show! "The Andrews Sisters" and Guest Stars Sundays 4:30 P.M. E.W.T. Blue Network

DIVISION OF NASH-KELVINATOR CORPORATION
Kenosha • Milwaukee • DETROIT • Grand Rapids • Lansing

period can thus be assured.

Distribution now accounts for a large part of the cost of liquefied petroleum gas. Reduction in price could result from lower handling charges. In the year 1927 users of liquefied petroleum gas in the United States were estimated at 20,000; in 1927 at 400,000; in 1940 at 800,000; and in 1941 at 1¼ million. The potential liquefied petroleum gas market has been estimated at ten million users.

Factors Affecting Sales

Factors expected by the industry to affect increased post-war sales will be: (1) Improvement in design of appliances; (2) safety devices and (3) reduction in distribution costs. Past experience has proved that the installation of a large storage tank on the farm for tractor and truck use offered a convenient means of utilizing butane for complete domestic use, for piping to the dairy barn for sterilizer use, and to the poultry house for incubation and brooder use. One delivery or dump into the central storage tank is made by the distributor at agricultural prices for the entire farm use.

It is the opinion of many that electric utilities are handicapped in meeting this type of competition by not having some comparable all-farm electric rate. One logical way, of course, to meet this and other competition is to render a superior service and to sell it intensively.

The Food Freezer as a Load Builder

By PAGE E. GOLSAN, Jr.,
New York State Electric & Gas Corp., Monticello, N. Y.

Power companies will have in the food freezer a new load-builder for rural lines in the years ahead. The usual size freezer unit uses about $30 of power annually and the total load may add ultimately as much as three percent or five percent to revenues, certainly new business well worth going after.

The average size home or farm freezer has a zero degree storage compartment, of about 14 to 26 cu. ft. capacity, holding 500 to 1,000 lb. of food. This unit also has a freezing section, operating at —10 deg. F., in which the air is circulated by a small fan, thereby increasing the freezing effect to that of still air at some 25 deg. lower. If 1,000 lb. of food is in storage and withdrawals are about 30 lb. a week, a small family will be supplied with fresh food for 30 to 35 weeks.

The retail food bill for an average small family runs $750 to $1,000 per year, and if you supply most of this to yourself, you put just that much money in your pocket. On such a basis the freezer will pay for itself in from two or three years, to say nothing of the advantages of off-season extra vitamins and fresh flavors.

One suburban gardner, not a farmer, reports his total cash expenditure last year for groceries and meat was only $300; all other food he raised and zero stored at home.

Will the sales of farm freezers come up to manufacturers' expectations? Certainly plenty of sales effort is planned. It has been said that 400 companies are looking into the manufacture of these units; actually only 187 have signified to WPB their intent to make either large freezers or a small refrigerator type or both. One manufacturer sold 15,000 units in the first three months of 1944 and the pent-up demand is reported to be heavy. Some manufacturers estimate that from 500,000 to 2,000,000 will be sold the first year after the war but the latter figure seems high.

The Freezer Market

H. C. Thuerk states in the June, 1944, EEI Bulletin that within three years after the war, it is expected that 1.5 million new farm customers will be added, bringing the total to 4.1 million compared to 2.6 million farms now connected. In addition, 1 million new rural non-farm customers will be connected.

These 5.1 million customers will be the focus of sales effort for the home and farm freezer and will, of course, fit in with the need for placing rural extensions on a self-sustaining basis as quickly as possible.

The farm market ought to show a fairly good acceptance of freezing because of the economics of self-supporting subsistence. But farmers are slow to buy and not all of them have the money.

The 25.5 million residential customers constitute the remaining prospects to make up the potential market. (Commercial customers are not considered in this market.) The total prospects, therefore, number about 30 million, of which perhaps 5 million are fair to good, and 25 million mediocre to poor.

Locker Plants

If we indiscriminately apply the past growth rate of refrigerators to this total as a shot gun estimate, we get startling figures; 3,060,000 quick freezers in use by the end of 1947 and 19,890,000 by the end of 1957. These figures appear much too high because of competition, yet the optimistic freezer boosters speak in these terms.

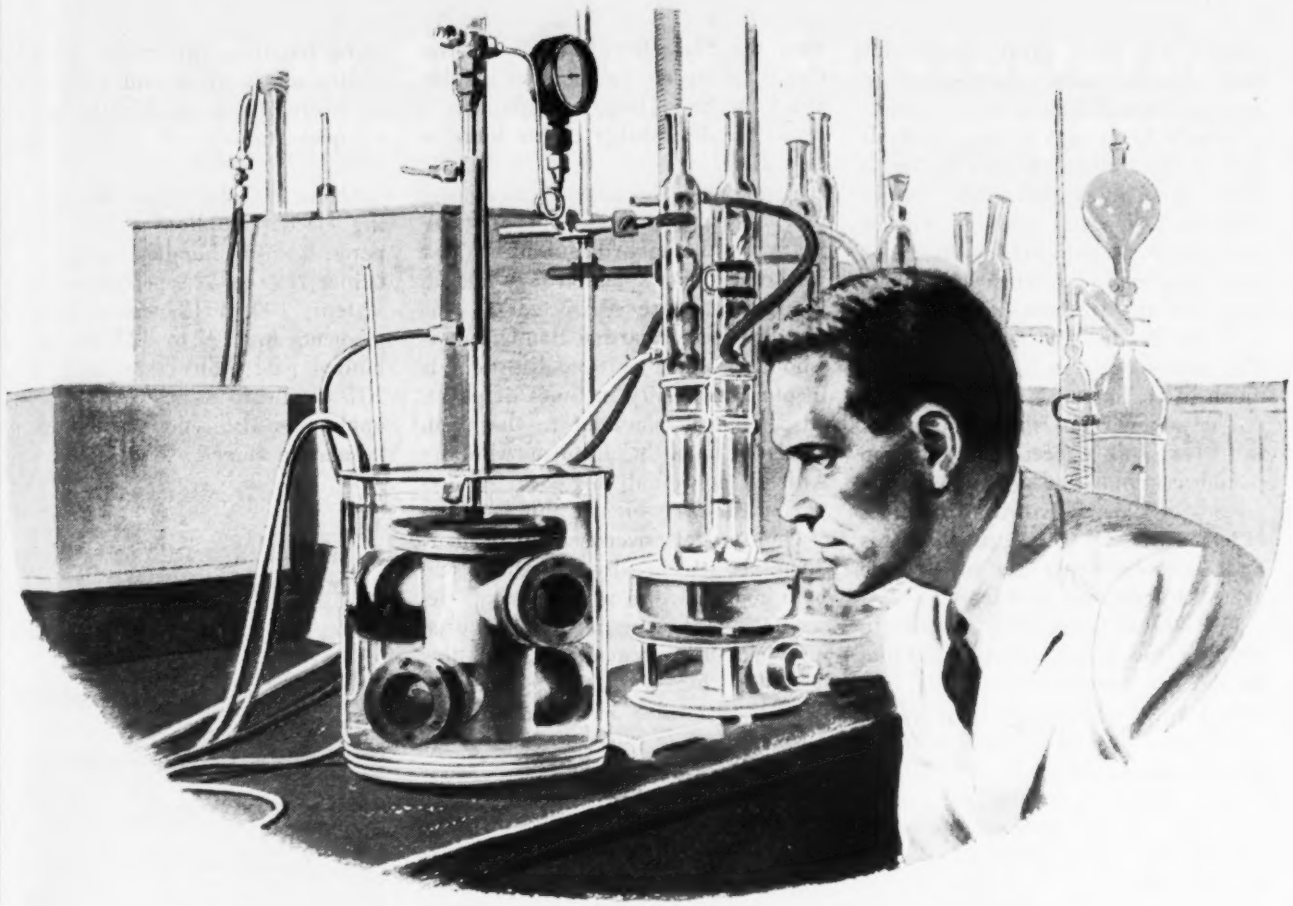
The first competitor is the frozen food locker plant which will be used by many people instead of home freezers. This business was on the upgrade before the war until construction was restricted and will expand further after the war. By the end of 1944 there will be about 5,000 locker plants in operation with 1,750,000 lockers serving 1,500,000 families. The outlook here is for an increase to 2,100,000 families using locker service in 1947 and 3,900,000 ten years later.

Some of these families will use home freezer units along with their lockers. Locker plant owners say that the freezer, with zero storage, is a good supplement and estimate that one quarter or more of their customers, even now, are anxious to purchase freezer units. If this one quarter basis is true, then the number of units sold to locker users would be 525,000 by the end of 1947 and 975,000 by 1957.

Adjusting downward the first shotgun estimate for the locker plant users not freezing (three-quarters), the figures for freezers in use are 3,375,000 units by 1947 and 17,670,000 units by 1957.

Commercially Frozen Foods

The second competitor is commercially frozen foods sold through retail stores. The home freezer market for residential city and suburban cus-



How will this "Soxhlet" help give Frigidaire Dealers still better products to sell?

FEW PEOPLE have ever seen this "Pressure Soxhlet," a unique instrument developed by Frigidaire Research Engineers. It's used to "turn a refrigerator mechanism inside out" . . . to examine every part and material of a mechanism . . . to see what happens through a "lifetime" of operation.

The "Soxhlet" is only one demonstration of that spirit of creative research which has spurred Frigidaire Engineers on to new leadership — year after year.

Proof of this Engineering leadership is in all the major advancements Frigidaire has contributed to make modern refrigerators so convenient, dependable, and economical!

To name only a few —

Frigidaire and General Motors pooled their scientific knowledge to develop "Freon," the world's first and only *safe* refrigerant.

Frigidaire led the way to better refrigeration of fruits and vegetables with the Hydrator . . . provided temperature regulation, sped ice freezing, simplified dessert making, with the Cold Control . . . offered the first Frozen Storage Compartment.

Frigidaire was first to provide trigger-quick ice cube release, with its celebrated Quickube Tray and Automatic Tray Release.

Frigidaire set new standards of performance and economy with its famed Meter-Miser, the simplest refrigerating mechanism ever built!

Frigidaire opened an entirely new era of more efficient, more convenient food preservation with the development of the Cold-Wall refrigerator.

And these are only a few examples of the Engineering leadership that has helped Frigidaire Dealers maintain consistent *selling leadership!*

It also provides the Frigidaire Dealer with the strongest assurance of product and selling leadership in the future. He *knows* that he will be able to offer his customers the kind of advanced refrigerators, electric ranges and other appliances that they are expecting. *He knows* that he will be able to take fullest advantage of the great selling opportunities that lie ahead. *He knows* Frigidaire Engineering will always provide better *and better* products for Frigidaire Dealers to sell.

3 Reasons for Frigidaire Engineering Leadership

1—Frigidaire maintains a *complete* Research-Engineering Organization, an organization skilled in not just one or two sciences, but in *all* the sciences concerned in the products it manufactures—chemistry, electricity, mechanics, metallurgy, ceramics, and the rest.

2—Frigidaire Research is never satisfied. Long before a product reaches Frigidaire Dealers and the public, Frigidaire Engineers are searching for ways to make it better.

3—Frigidaire Engineering is backed by the tremendous resources of General Motors.

Look to Frigidaire for Leadership through Engineering!

For Excellence ARMY E NAVY *in War Production*

FRIGIDAIRE

Division of

GENERAL MOTORS

DAYTON 1, OHIO • LEASIDE 12, ONTARIO

Peacetime Builders of

ELECTRIC REFRIGERATORS • RANGES • WATER HEATERS
HOME FREEZERS • ICE CREAM CABINETS
COMMERCIAL REFRIGERATION • AIR CONDITIONERS
BEVERAGE, MILK, AND WATER COOLERS

tomers will meet great competition from this business. Aggressive organizations will give a wider variety of frozen foods than is now available and if the volume proves to be as large as many expect, then freezer sales in residential markets will be quite small, perhaps mainly those who have vegetable gardens and others who find the freshness of off-season food worth the trouble of freezing. The cash saving is too small to be much of an influence.

The commercial frozen food pack in 1944 will exceed 500 million pounds as compared with 30 million pounds in 1934; a growth of 16 times in ten years. Of course, much of this total in recent years has gone to the armed forces and lend-lease.

For lack of better data, assume (to see how the figures come out) that the sales of freezers to residential customers will be about one-tenth of the refrigerator record in such districts. On this basis, the totals are 310,000 freezer units in operation among farm and residential customers by the end of 1947 and 2,827,500 by the end of 1957.

According to reports on power usage, a family size, 26 cu. ft. quick freezer consumes about 2,000 kw.-hr. per year. At 1½¢ per kw.-hr. (probably lower than the average follow-on block) this size unit will yield $30 of annual revenue. This will be desirable revenue since the motor is comparatively small and the load factor high with diversity.

Applying this $30 revenue to total estimate of freezers to be sold, the business may represent a prospective national gross income for electric utilities upwards of $80 million, which is 3.8 percent of revenues in the prewar year 1939.

It is possible that the market among residential customers will be larger than this estimate. For each 1 percent increase, about $8 million will be added to total annual revenue.

This business holds real possibilities for utilities in the years ahead; the revenue possibilities are large and the load is desirable.

•

Utility Sells City to War Workers

In an unusual bid to encourage present out-of-city war workers to remain in San Diego, Cal., after the war, the San Diego Gas & Electric Co. is taking six full-column display space in San Diego newspapers to extoll the desirability of life there in peacetime.

In a sense, the advertisements are tourist appeals directed to tourists already in the city disguised as war workers. It is explained that the advertisements are "directed to the many thousand wartime San Diegoans who have never enjoyed life as it is in our community in times of peace. Also, it is a reminder to the thousands of men in uniform who are with us, many only temporarily, preparing for their biggest job."

One typical advertisement headed: "Another reason why San Diego will be a good place in which to live" describes in glowing terms the ocean and lake fishing available, but now curtailed by wartime restrictions. This is illustrated by a large photograph of a deep sea fishing scene taken on a fishing barge.

A special booklet "San Diego Facts" is offered by the company to interested readers "describing our peacetime living" and "prepared in the interests of a Greater Post-War San Diego."

Only a nominal proportion of the space is taken for institutional advertising.

•

What Types of Stores Sell Electric Appliances

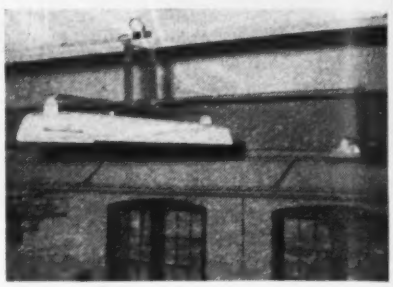
The number and type of retail stores handling electrical appliances in the territory served by the Wisconsin Power & Light Co., and the types of farm equipment sold by the same outlets was revealed among the findings of a recent dealer survey conducted by this Wisconsin utility.

Hardware stores accounted for more than a third of the 605 retail stores handling appliances. Electrical contractors were second with 63 and furniture stores third with 58. The complete tabulation is shown herewith.

Of the 605 dealers of all types selling electric appliances 135 or 22.3 percent also handle milking machines; 199 or 32.9 percent sell water system; 109 or 18 percent farm implements and 197 or 32.5 percent sell bottled gas. More than half of the 207 hardware stores selling electric appliances also sold bottled gas, the tabulation shows.

•

Fixture Mounting for Sloping Roof



JOB OF MOUNTING lighting fixtures from the beams of a sloping roof so all are equidistant from the floor was solved recently by lighting engineers of Indiana Service Corp., Fort Wayne in the manner shown. They used 2 by ¼ in. channel for the fixture support. Vertical elements, graded in length to the pitch of the roof, were bent around the flanges of the I-beams supporting the roof and clamped with a bolt. These verticals were welded to the horizontal member which is fastened to the fixture at its ends. Compare the long vertical members supporting the fixture in the right background with the shorter ones on the fixture in foreground

•

Types of Dealers—Wisconsin Power & Light Co.

Type of Dealer	Electric Appliances	Other Farm Equipment Sold: Milking Machines	Water Systems	Farm Implements	Bottled Gas
Retail Appliance	51	5	9	2	22
Electrical Contractor	63	4	7	2	8
Repair Shop	16	.....	.....	1	.....
Dept. or Gen'l. Mdse	49	20	23	16	24
Furniture	58	.....	.....	.....	9
Hardware	207	62	89	53	119
Drug	9	.....	.....	.....	.....
Plumber	55	7	43	2	8
Tin Shop	1	.....	.....	.....	.....
Garage	9	1	1	1	.....
Filling Station	8	2	1	1	1
Farm Implement	45	33	24	30	5
Miscellaneous	34	1	2	1	1
Total	605	135	199	109	197

For War Service a Manufacturer specified this *Essential* Paper:

YOU may need a paper with characteristics entirely different from the one specified in the "prescription" shown above — but whatever your requirements, you will find at Mosinee the scientific laboratory and production controls of ingredients and processes, plus broad, practical experience, to assure successful performance of the particular paper you specify.

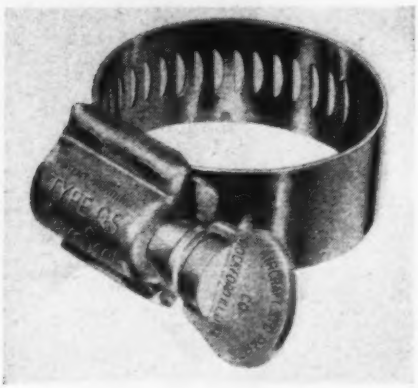
In present problems of war production involving paper, or in plans for postwar products, The Mills of Mosinee are qualified to serve you well.

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. B"

NEW EQUIPMENT

Hose Clamp



Stainless steel hose clamp; worm gear drive; vibration-proof holding; uniform pressure; **Aircraft Standard Parts Co.**, 1729 19th Ave., Rockford, Ill.

Light, thin bands are said to be of high strength and flexibility and to be rust resistant. Mechanical interlocked saddle is reported to eliminate welds at that point. All nominal sizes from ½ in. to 4½ in. will be available.

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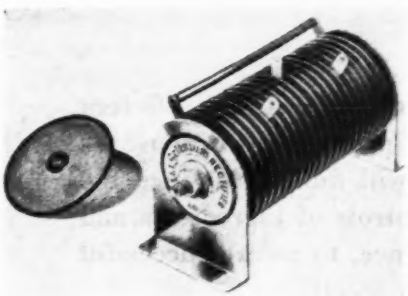
Rectifier



"Center Contact" selenium rectifier; **Federal Telephone & Radio Corp.**, Newark, N. J.

Center contact allows complete coating protection against corrosive atmospheres. Said to be applicable to radio, communication, aviation, and electronic uses. Model is reported as available in same range of sizes and capacities as pedal-type contact.

•

Comparison Specimens

Standard surface—roughness specimens; 2 by 2½ by ⅛ in.; **General Electric Co.**, Schenectady, N. Y.

Set of 10 standard surface-roughness specimens, each designated by a symbol, which facilitates selecting proper finish and its designation by a proper symbol. Several of the specimens are divided into two and (or) four surfaces, equally rough, but produced by different machining operations. They are protected by a cloth lined wooden case.

•

Heaters

"Electrodmode" portable type unit heaters; 18 kw.; 50-ft. rubber-covered cable; **Electric Air Heater Co.**, Mishawaka, Ind.

Portable type heaters have sheathed resistor, as a heating element, sealed in a one-piece finned aluminum casting with motor-driven fan mounted directly behind this element. It is complete with 50-ft. of cable and connector.

•

Lubricant

Oil concentrate; **Hood Refining Co.**, North Hamilton Ave., Greensburg, Pa.

Concentrate is reported to mix with any type of lubricating oil, not to settle out, and not to be extracted by filtering. Manufacturer recommends one part of concentrate to eight parts of lubricating oil for use in internal combustion engines, turbines, air compressors, pumps, etc.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Heating Element

Funnel-shaped heater; 125 v. a.c. or d.c.; ½ to 20 w. per sq. in.; **Lander & Gyr, Inc.**, 104 Fifth Ave., New York 11, N. Y.

Heating element manufactured as a completely sheathed unit. Illustration is representative of shapes which can be provided. It contains a woven type heating element. The assembly is covered by a metal spinning, the units are also manufactured with Fiberglas covering or with bare resistance wire. Thickness of units, which is dependent upon diameters of resistance wire, varies from $\frac{1}{32}$ to $\frac{1}{16}$ in.

•

Load Indicator

Load indicator; 7 sizes rated from 21 to 210 amp. at 240 volts; dial registration in percent of full load (200 max.); max. wt. 6.4 lbs.; **Electric Power Equipment Corp.**, Philadelphia, Pa.

Porcelain housed current indicator, which can be mounted either on a rack or supported by phase wire, so that the dial can be read from below, operates as thermal instrument. Used to determine maximum demand on transformers and circuits. Instrument has two pointers, the first of which is actuated by current variations and the second is moved upwards by the first. The second pointer indicates the maximum load in the circuit and is hand reset to obtain new demand indication. The indicator is said to be weatherproof.

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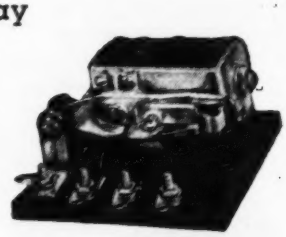
Relay



Type "79XAX" relay; **Struthers-Dunn, Inc.**, 1321 Arch Street, Philadelphia 7, Pa.

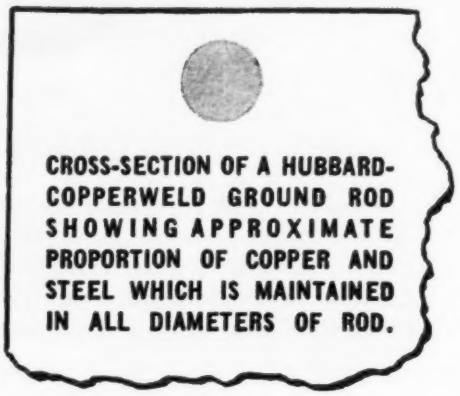
Armature of relay is said to complete its travel in either direction before contacts snap into the new position, which makes it applicable to vacuum tube circuits, overcurrent protection, pulsing circuits, etc. Standard adjustment using 60-amp. turns in the coil at approximately .02 watt reported to result in contact pressures of 5 grams with contacts rated at 5 amp., 115 v. ac. or 0.5 amp., 115 v. dc. Contact ratings up to 10 amp., 115 volts a.c. can be obtained with 100 or more amp. turns. Sensitivity of 0.005 watts with 30-amp. turns is obtained with reduced contact pressures and ratings.

HUBBARD-COPPERWELD

GROUND RODS AND CLAMPS

DESIGNATES LENGTH OF ROD

Grounding Wire
Safety Screw
No. 9492 Clamp
Five safety screw wrenches are furnished with every 100 clamps
Square Head Bolt
⅝" Diam. Hubbard Copperweld Ground Rod
No. 9592 Clamp



CROSS-SECTION OF A HUBBARD-COPPERWELD GROUND ROD SHOWING APPROXIMATE PROPORTION OF COPPER AND STEEL WHICH IS MAINTAINED IN ALL DIAMETERS OF ROD.

NO. 9440 ⅝" x 10 FT. HUBBARD-COPPERWELD ROD

RODS—DIAMETERS FROM ⅜" TO 1"—LENGTHS FROM 5 FT. TO 40 FT.

CLAMPS—TWO STYLES, SAFETY SET SCREW AND SQUARE HEAD BOLT—FOR ALL DIAMETERS OF RODS.

HUBBARD AND COMPANY

EXCLUSIVE NATIONAL SALES AGENT FOR COPPERWELD GROUND RODS AND CLAMPS

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

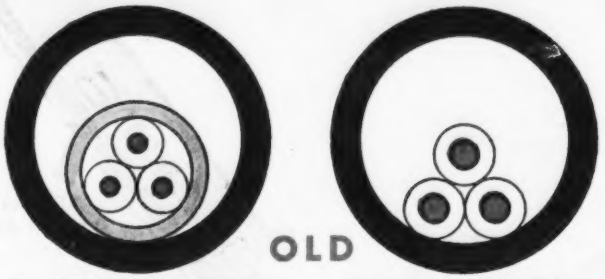
● IMPERIAL NEOPRENE JACKETED PORTABLE CABLES ●

BUILDING WIRE ● SERVICE ENTRANCE CABLE ● CRESFLEX NON-METALLIC SHEATHED CABLE ● ARMORED CABLE ●

PERMACORD ● LEAD-ENCASED AND PARKWAY CABLES ● SYNTHOL WIRES ● WELDING CABLES ● SHIPBOARD CABLES

CRESCENT SYNTHOL Type SNW

For More Copper In Wet Locations

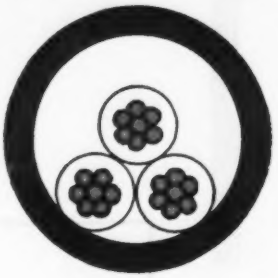


OLD

No. 14/3 Conductor, Type RL Carries 15 amps.

Three No. 10, Type RW Carry 25 amps.

For ¾" Conduit



NEW

Three No. 6, Type SNW Carry 54 amps.

Insulated with a special thermoplastic that is extremely resistant to moisture, acids, alkalies and oil, inherently flame-retarding, high dielectric and mechanical strength, bright permanent colors, small diameter, easy pulling, free stripping

SYNTHOL Type SNW

is approved by Underwriters Laboratories in sizes from #14 through #4/0 AWG under section 3035 of the 1940 N.E. Code for use in raceway systems, such as: (a) Underground, (b) In concrete slabs or other masonry in direct contact with the earth, (c) In wet locations, (d) Where the condensation and accumulation of moisture within the raceway is likely to occur.

Write for Descriptive Folder on SYNTHOL Types SNW and SN

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

Available Through Electrical Wholesalers

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TECHNICAL LITERATURE

Flexible Shaft Handbook (second edition)—Details industrial applications including grinders, mica undercutters, concrete vibrators, tachometers, testing equipment, etc. Tells how to select type and size (including end connections), cut to length, determine minimum operating bend-radius; graphs given for torsional deflection and torque-radius. Obtainable on business letterhead from S. S. White Dental Co., 10 East 40th Street, New York 16, N. Y.

V-Belt Drive—A primer-like presentation of the basic advantages has been prepared by the Engineering Research Committee of the Multiple V-Belt Drive Association. The booklet ("19 Reasons Why It is the Dominant Drive of Industry") may be procured by writing the Association headquarters at 140 S. Dearborn St., Chicago 3, Ill.

Chain Hoist—A 12-page bulletin entitled "The Chain Hoist of Tomorrow, Today and Yesterday" can be had by addressing the Chester Mfg. Co., Lisbon, Ohio. It illustrates and describes hoists and trolleys; care and operation of the equipment are also noted. Also described are some of the small things to check and do.

Belting Manual—A reference book in power transmission called "Leather Belting Selection and Application" may be obtained from Graton & Knight Co., 356 Franklin St., Worcester 4, Mass. It contains charts, data and specifications to support the following headings—how to pick the right belt for the job, figuring belt dimensions, how to compare efficiency and cost of multiple V-Belt drives and flat leather automatic tension drives, and how to make belts deliver more power and last longer.

Iron Cores—Uses and functions of powdered iron cores; permeability and "Q" of various materials at different frequencies; effects of the addition of adjusting screws; copper cores; mechanical considerations; standard and special pieces, are subjects covered in a 36-page booklet, "Magicore High-Frequency Iron Cores," available to any designer, engineer, purchasing agent or production man writing on his business stationery to Henry L. Crowley & Co., Inc., 1 Central Ave., West Orange, N. J.

Ethyl Cellulose—A 48-page booklet containing "The Properties and Uses of Ethyl Cellulose" is obtainable from the Cellulose Products Department, Hercules Powder Co., Wilmington, Del. Twenty-two tables and eleven graphs illustrate and explain the effect of ethyl cellulose in various formulations.

A second booklet, "Ethyl Cellulose Formulations with Resins and Plasticizers" is also obtainable. The book is intended to eliminate unnecessary research on the part of formulators by providing a basis for formulation of ethyl cellulose lacquers, adhesives, plastics and hot-melt coatings.

Standardization—Signal Corps Tentative Specification 71-4902 is available from Army Service Forces, Signal Corps Standards Agency, 12 Broad St., Red Bank, N. J. This booklet was prepared for prime contractors of Signal Corps equipment and is available to all component parts manufacturers and materials suppliers.

Setting Up and Operating a Welding Business—Three prize-winning papers by proprietors tell how to organize and operate an efficient establishment competently and profitably. May be obtained from the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

1 Emergencies call for quick action. 2 Without delay, dispatcher calls truck closest to the trouble. 3 Repair crews get to the trouble quickly by the shortest route. 4 Service restored. Truck on its way to next job.

G-E 2-way FM radio speeds repairs

Wherever and whenever power disruption threatens, maintenance must get on that job—fast.

G-E 2-way FM radio is a powerful coordinator that enables you to communicate direct with your field repair crews and enables them in turn to communicate with each other. It is an important maintenance tool that will help you through every emergency and improve your service continuity. It will give you effective communication day and night, through every kind of weather.

In serving your radio communication needs, General Electric offers you the same specialized attention that is extended to you in your power distribution and maintenance requirements. Call your General Electric sales engineer when you discuss your communication problems. He will have a specialist assist in planning the most effective system for your particular installation. Write to *Electronics Department, General Electric, Schenectady 5, N. Y.*

Government regulations now permit new installations of 2-way FM radio for important requirements of utility companies. Let your G-E representative help prepare your applications.

Write for these booklets: "G-E FM Communication System Guide" gives you practical facts about the selection of 2-way FM radio and will assist you in estimating total installation costs. "G-E FM Communication Equipment Catalog" describes and illustrates the required units and equipment.

Hear the G-E Radio programs: *"The World Today" news, Monday through Friday, 6:45 p. m., EWT, CBS. "The G-E All-Girl Orchestra." Sunday 10 p. m., EWT, NBC. "The G-E House Party," Monday through Friday, 4 p. m., EWT, CBS.*

Everything for 2-way radio communication

GENERAL ELECTRIC

NEWS ABOUT PEOPLE

Bay State Operating Men Assume New Duties

Howard J. Cadwell, whose appointment as vice-president in charge of operations for the Western Massachusetts Electric Co., Greenfield, Mass., was recently mentioned in Electrical World, has been engaged in public utility service in the middle Connecticut Valley since 1929. He was chiefly instrumental in the changeover from gas to electric service in the Amherst and Easthampton, Mass., companies, and in 1941 was made assistant treasurer of the Western Counties, Amherst and Easthampton companies. From 1933 to 1935 he was located in the Springfield office as rate engineer, and in the latter year was transferred to Greenfield as sales manager of the Western Massachusetts company. In 1940 he was appointed assistant to the late Fred L. Hunt, vice-president of the system, and in 1943 was made manager of operations. He is also vice-president of the Quinnehtuk Co.

Arthur L. Davis, whose appointment as general superintendent of the Western Massachusetts Electric Co., with headquarters at Turners Falls, Mass., was also recently noted in Electrical World, succeeding Charles F. Mosher (now a director) was employed by the Bangor (Me.) Hydro-Electric Co. from 1916-1928, first as assistant engineer, then as acting engineer, and for the last five years as chief engineer of that utility. From 1928 to 1931 he was assistant superintendent of distribution for the Alabama Power Co., returning north in the latter year as assistant general superintendent of the Western Massachusetts system. Mr. Davis is now president of the Electric Lines Club of New England, and a past chairman of the Overhead System Group of New England and the Springfield (Mass.) section, A.I.E.E.

Robert R. Habberley, who was recently appointed assistant general superintendent of the Western Massachusetts Electric Co., with headquarters at Springfield (ELECTRICAL WORLD Jan. 6, page 118), joined that system in 1930 as district engineer in Greenfield, going to Springfield as supervisor of operations in 1931. Later that year he became assistant superintendent and then in 1934 superintendent of distribution at Springfield, for the then affiliated United Electric Light Co. He is a past chairman of the Underground Distribution Engineers of New England and a director of the Engineering Society of Western Massachusetts.

Bernard J. Dowd, newly named superintendent of distribution, joined the then United Electric Light Co. in 1916 after serving in World War I, and progressed through various positions until he was made assistant superintendent of distribution in 1934.

Jairus F. Burt, recently appointed general sales manager and assistant manager of the western division with headquarters at Pittsfield, has been with the company about 20 years. He has recently been sales manager at Pittsfield, but will now have charge of this work for the system.

C. E. Bankwitz, recently named manager of the Western Masachusetts Electric Co., central division, Turners Falls, has been with the system 28 years, much of his work being in the accounting department. He will serve as assistant treasurer of the Western Massachusetts Electric and the parent Western Massachusetts Companies.

John E. Welch has been appointed service engineer, Springfield division, succeeding John M. Turnbull. Mr. Welch entered the company's service as a draftsman and returned to its engineering staff after being loaned for an interim period to the Westinghouse company.

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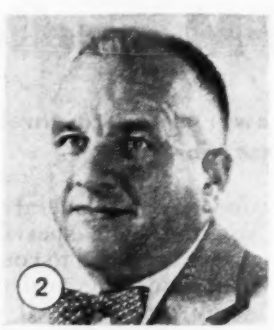

1. H. J. Cadwell
2. A. L. Davis
3. R. R. Habberley
4. B. J. Dowd
5. J. F. Burt

► THEODORE O. RUDD has been elected vice-president of the Kerite Insulated Wire & Cable Co. A graduate of Sheffield Scientific School, Yale University, Mr. Rudd worked in the construction department of the Public Service Electric & Gas Co. of New Jersey during the summer months and after completion of his university course, he became a cadet engineer of the Philadelphia Electric Co. In 1926 he joined the Kerite engineering staff and became assistant to the late Col. Azel Ames, whose duties he later assumed. Mr. Rudd is a member of the American Institute of Electrical Engineers.

► W. E. MITCHELL, vice-president and general manager, Georgia Power Co., Atlanta, has been appointed by the U. S. Chamber of Commerce to its Natural Resources Department committee for 1944-45.

► G. E. HEBERLEIN, chief engineer of the Railway and Industrial Engineering Co., Greensburg, Pa., since 1941, has been elected to the company's board of directors. Mr. Heberlein had been previously employed by the Westinghouse

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Here's the Ryerson network of eleven plants strategically located to give you prompt, dependable steel-service. Stocks on hand include bars, shapes, structurals, plates, sheets, tubing, etc. — carbon, alloy, Allegheny stainless and tool steel. At present our service cannot always be as fast nor our stocks as complete as under normal conditions. Nevertheless, deliveries on anything from a single piece to several tons are generally satisfactory.

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Our latest stock list describes our complete line—more than 10,000 kinds, shapes and sizes of steel. This buying reference is a veritable "book of knowledge". It gives descriptions, sizes, weights, specifications and cutting extras for every kind of steel. Our nearest plant will be glad to furnish you a copy.

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TO CUT
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PORTER HKP CUTTERS work anywhere that two normally strong hands are available to put a few pounds pressure on the handles. Toggle-joint leverage will increase this pounds pressure to tons pressure on the jaws and even case-hardened chain can be cut "where is and as is". Standard models meet most production, construction, maintenance and emergency requirements.
The same power principle is applied to special tools for heading, pressing, crimping, punching and caulking with equal effectiveness. Send for our free booklet on tool maintenance to make clippers, saws, chisels, files and other tools do better work and last longer.
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PORTER HKP CUTTERS

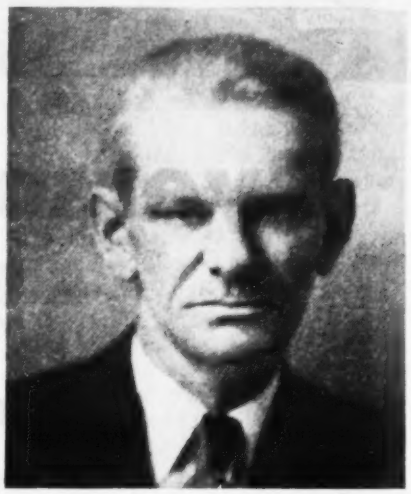
Electric & Manufacturing Co. for fifteen years as development engineer and manager of switchgear device sales.

•

C. W. DeForest Retires from Columbia System

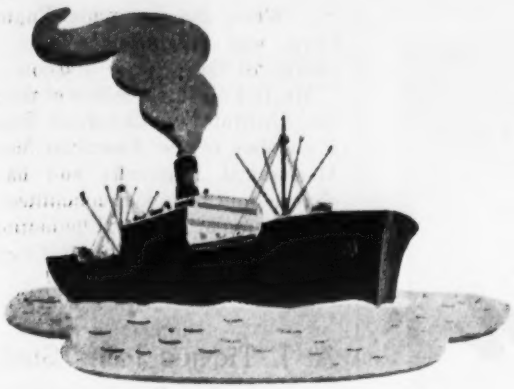
Cornelius W. DeForest has retired as vice-president of the Columbia Engineering Corp., New York, and automatically from its affiliate the Cincinnati Gas & Electric Co.

A native New Yorker, Mr. DeForest obtained his early experience with the General Electric Co., Schenectady, and with the Brooklyn Edison Co. and the United Electric Light & Power Co., New York. He went to Covington, Ky., 42 years ago as chief engineer of the Cincinnati, Newport and Covington Street Railway Co. and of the Union Light,



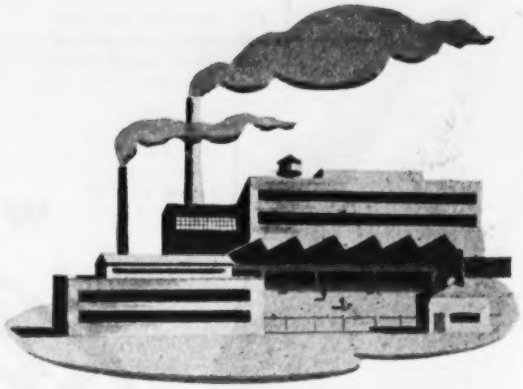
Heat & Power Co. in Covington and Newport when these companies became affiliated with the Union Gas & Electric Co., now the Cinicinnati Gas & Electric Co., under Columbia Gas & Electric control. Mr. DeForest was brought to Union Gas as electrical engineer of both the Cincinnati and Kentucky companies subsequently to be made manager of the electrical department and later vice-president of the Union Gas & Electric Co. in charge of engineering and operation of the electrical department. In 1916-18 he supervised construcion of the West End power station, as well as the new underground transmission and distribution system.

To meet the increased local demands, the Columbia Power Co. was organized in 1923 and Mr. DeForest was made vice-president, with the special assignment of selecting a site and supervising the design and construction of a new power station. The site at Columbia Park was chosen and the plant was placed in operation in 1926. The station, supplying Cincinnati and surrounding areas, has increased its capacity two and one-half times over its initial capac-



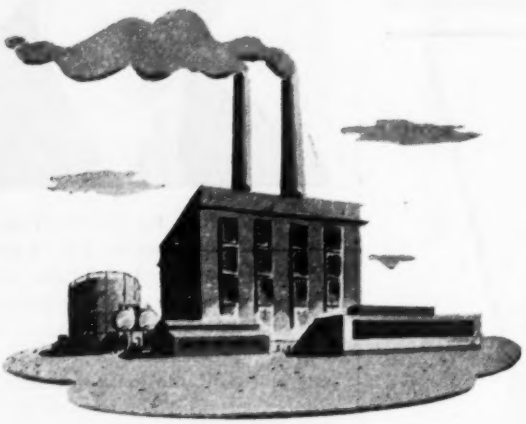
COOLER — CLEANER — LONGER LIFE

Early tube failure was traced to plug-type dezincification, with a change of metal indicated. But Scovill *Service in Metals* blamed unusually high temperatures and insufficient tube cleaning. Better operation lengthened life of replacement tubes many years.



LOCALIZED INFECTION CURED

Persistent failure of two rows of tubes in the first pass of a condenser was puzzling, because tubes in adjacent areas were normal. Scovill *Service in Men* helped the chief engineer work out an inexpensive construction change, ending the premature failure.



USEFUL TO UTILITIES

Scovill's Condenser Tube Booklet will be found in many a utility power plant — on industrial and marine engineers' desks, too — because it gives valuable information on metals, installation, analyzing trouble sources. It is part of Scovill's *Service in Manuals.*

Many power plant operators look first to Scovill for news on new developments . . . advice on installation practice . . . help in solving problems — because Scovill is

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THREE SERVICES

For a free copy of the new Scovill Condenser Tube Booklet, write SCOVILL MANUFACTURING CO., 24 Mill St., Waterbury 91, Conn.

The rounded nose permits working in confined spaces—no sharp edges to nick wires
Matched jaws—serrated inside—for sure grip
Sharp knives are matched and honed to assure clean cutting
"Hand fit" handle
Hinge—perfect fit—jaws do not get out of alignment
Spring tempering in the handle, prevents tiring hands
Perfect balance with weight properly distributed makes Klein's easier to use
KLEIN TOOLS
CHICAGO, U.S.A.

WHY

Klein Pliers

STAND FIRST

Ask a lineman—electrician—or a skilled craftsman in any field why he prefers Klein pliers. He may mention the balance of Kleins that makes them feel comfortable—the sharp knives that stay keen even after years of service—the jaws that grip tight or the spring in the handles that prevents tired hands.

All of these qualities are evidences of the careful design—the years of experience—the hand-craftsmanship methods by which Klein pliers are made.

But even more they typify the careful control of every step in the manufacture—from the specification of the high grade tool steel made to our analysis to the individual inspection every pair of Klein's receives before it is boxed ready for shipment.

Obviously it costs more to produce pliers by Klein craftsmanship methods—but users of good tools recognize that the higher quality of these tools—the better service they render—the longer life they assure—are well worth the additional cost.

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp., New York

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
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ity. When the Columbia Engineering Corp. was organized he was put in charge of the electric division.

Mr. DeForest is a fellow of the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers and has been chairman of technical committees of the Association of Edison Illuminating Companies and of the Edison Electric Institute.

•

A. J. Tigges Joins Staff of Air Preheater Corp.

Alexander J. Tigges has been appointed district technical advisor of the Air Preheater Corp., with offices in New York.

For twenty years with Jackson & Moreland, Boston, Mr. Tigges has most recently served as manager of consulting engineering for the Baldwin Locomotive Works, Chester, Pa. A graduate of the Massachusetts Institute of Technology, he was project engineer during the construction of Boston Edison's Mystic power station and other important power plants including those for a number of oil refineries in the southwest.

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▶ PRENTISS M. BROWN, chairman of the board, Detroit Edison Co., has been made a member of the business advisory council of the U. S. Department of Commerce.

▶ SANFORD A. MOSS, General Electric consultant and internationally celebrated for his pioneer work on airplane superchargers, received recently a turbosupercharger that functioned flawlessly in a Flying Fortress during a record number of 102 missions over Europe. Dr. Moss received the gift from Capt. W. E. O'Brein of Milwaukee, who represented the donor, the 381st Bomber Station in England. Army Air Force mechanics hailed the charger as a

"hyper-tested wonder." A congratulatory message from General Henry H. Arnold, of the Army Air Forces, was read at the ceremonies.

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New Officials Appointed by National Carbon Co.

C. O. Kleinsmith has been elected a vice-president of National Carbon Co., Inc., a unit of Union Carbide & Carbon Corp. and D. B. Joy has been named sales manager for carbon products.

C. O. Kleinsmith

Announcement was also made of the appointment of R. P. Bergan as general sales manager for the company's consumer and related products.

Mr. Kleinsmith was formerly general sales manager for the company's "eveready" products. Prior to his appointment to that position, two years ago, he was sales manager for eastern United States. He joined the company in 1919.

D. B. Joy

Mr. Joy joined National Carbon Co. in 1923 following graduation from Massachusetts Institute of Technology. He was made director of the company's process engineering laboratory at Fos-

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WHEN PLANNING your future stocks or installation work, get full information about Paragon Automatic Time Controls . . . because they offer possibilities for handsome profits. These instruments are used in plants of all types and are built into numerous kinds of equipment. They save time . . . multiply human output . . . reduce errors . . . increase efficiency . . . and lower costs. Because they have been extensively used and are widely advertised, Paragon controls offer you the opportunity of large future sales.

HUNDREDS OF APPLICATIONS—Some of the numerous applications of timers are: Protecting component parts, such as electronic tubes . . . Automatically turning air conditioning units on and off . . . Sequence Timing . . . Laboratory Testing . . . Conveyor Control . . . Light Exposure . . . Heat Treating . . . Pump Operation . . . Machinery Operation . . . Plastic Molding . . . Time delay on pump back spin...Controlling pre-heating schedules.

CALL THE PARAGON REPRESENTATIVE . . . for assistance in selection and correct application of Paragon controls.

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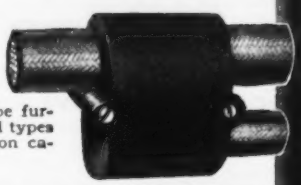
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

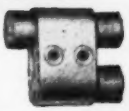
from the MOST COMPLETE lin
of Cable Taps

Now you can select from a really *complete* line of standard and special taps. Every one carefully designed and manufactured.

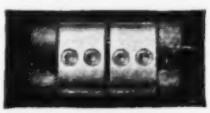
Parallel and 90° taps — and combinations — in the widest variety. For conductor sizes up to 1,000,000 CM.



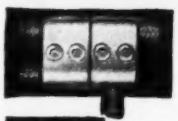
Gutter Tap with Bakelite Cover. Insulating covers can be furnished for all types of Penn-Union cable taps.



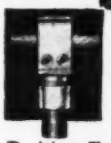
2-way Gutter Tap. Main and branch sizes 8 to 1,000,000.



Two Separate Parallel Taps to a continuous main conductor.



Combination Cable Taps; one branch parallel to main, and one at 90°.



Hinged Clamp of Penn-Union Type HFM makes installation easy. Multi-slit tapered sleeve assures permanent grip on branch.

Positive Equalized Pressure on main and branch, with Penn-Union Type SM. Tightening torque is accurate measure of the clamping force.

Also the *most complete line* of Service Connectors — Terminals — and thousands of other fittings, for all requirements.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

toria, Ohio, ten years ago, and in 1941 became assistant superintendent of the Fostoria factory. He was made product manager last year.

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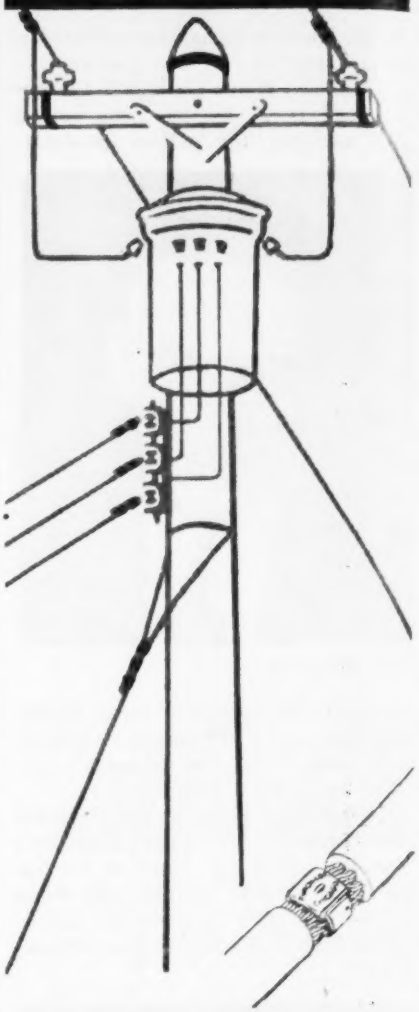
▶ R. R. ROBERTSON, chief electrical engineer and deputy general manager, Los Angeles (Calif.) Department of Water and Power, has retired. Mr. Robertson entered the employ of the Los Angeles Bureau of Power and Light in 1912. After service in World War I, he returned to the Bureau of Power and Light as construction superintendent. By 1940 he had become head of the division and when the water and power bureaus were merged in November, 1943, he was made chief electrical engineer and deputy general manager of the department of water and power.

▶ A. L. HALLSTROM, retiring vice-president of the Graybar Electric Co., Inc., was the guest of honor at a luncheon given recently by the Electrical Association of Philadelphia, in the Warwick Hotel in recognition of his outstanding contribution to the electrical industry during the past fifty years. Mr. Hallstrom was one of a group of twenty who founded the Electrical Association in 1917. He has been a member of the board of governors from the beginning, served as president of the association in 1925 and was again elected to the presidency in 1939, continuing in that office until 1944.

▶ CARROLL H. SHAW has become associated with Shaw-Rutan, Inc., New York, in the capacity of president. The name of this engineering firm has just been changed from Rutan & Snead, Inc., to Shaw-Rutan, Inc. Mr. Shaw has been identified with the engineering profession for a number of years, including Jackson & Moreland, Boston; New York Edison Co. and more recently with M. R. Scarff, consulting engineer, New York.

▶ H. ZINDER, who for the past seven years has been chief of the division of rates and research of the Federal Power Commission, has joined the staff of E. Holley Poe and Associates as a senior associate. During his association with FPC, Mr. Zinder was responsible for the direction and supervision of the commission's activities involving both electric and gas rates. He has spent 20 years in the public utility field, directing his attention especially to state and federal regulations. He was called to participate in the initial formulation of policies as to rates and the design of rates for such federal projects as the Tennessee Valley Authority, Electric Home and Farm Authority, Rural Elec-

PUNCH-LOK
Streamlined
Banding and Splicing Method



With Punch-Lok Clamps, applied with the Loking Tool, you can make connections easily, quickly, simply, safely... without taking down wires or installations. Will withstand any normal pull strain. Many other applications for repairing, banding, splicing, tying.

Write for descriptive catalog and name of nearest distributor

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trification Administration and others. From 1924-31 Mr. Zinder was with the Commonwealth Edison Co. of Chicago, most of the time in the contract department making engineering studies and carrying on sales activities on connection with large power sales. From 1931-35 he was chief rate analyst for the Public Service Commission of Wisconsin and was granted a leave of absence by this body to assist REA in formulating its rate policies. He subsequently joined the REA staff as chief of its rate section. In 1937 Mr. Zinder joined FPC and in addition to his regular duties as chief of the division of rates and research, he organized in 1942 the staff and supervised its activities in connection with the commission's review of large power contracts for government establishments.

▶ LEE C. WISE is now district agent in charge of electric and water systems recently acquired by the Pacific Gas & Electric Co. at Willits, Fort Bragg and adjacent areas in northern California, it was announced by the company which took over operation of the properties January 1 from the California Public Service Co. Preparations to improve transmission facilities in the area and to link local lines with P. G. & E.'s interconnected system are underway. Mr. Wise, with the P. G. & E. since 1930, recently was commercial agent of the St. Helena and Calistoga area. The new properties are part of the company's North Bay division under the direction of Clifford Bartlett.

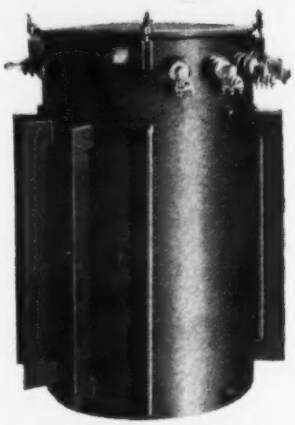
▶ L. M. LEEDS has been appointed manager, electronics laboratory of the General Electric Co.'s electronics department. W. C. WHITE, formerly in charge of this laboratory, has been appointed the electronics engineer of the G. E. Research Laboratory. Mr. Leeds will have his headquarters in Schenectady and will have charge of electronic research and advanced development for the electronics department. Since 1943, he has been an electronics consulting engineer for the company, as well as an expert consultant on radar and radio in the office of the Secretary of War, with offices located in the Pentagon Building, Washington.

▶ DR. FREDERICK E. TERMAN, has been named head of the engineering school of Stanford University, Palo Alto, Calif., succeeding Dr. Samuel B. Morris, who resigned recently to accept a position as chief engineer and general manager of the Los Angeles Department of Water and Power. Dr. Terman has been on leave from Stanford University's faculty since 1942, while serving as head of the government's radio lab-

NO. 2 OF A SERIES ON THE **Service Superiority** OF

DAVIS TRANSFORMERS

High all-day efficiency

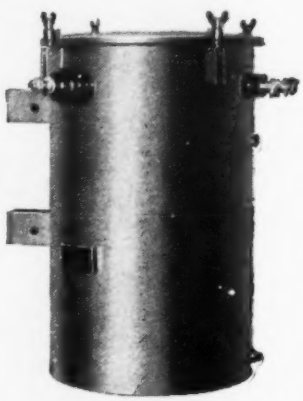


DAVIS 100 KVA, single phase, 2400-120/240 Volts, Oil-cooled

The design of Davis Transformers — a design based on our many years experience repairing and rebuilding transformers of every make, size and voltage — is to produce proper ratio between no-load and full-load losses. Smaller sizes in intermittent service have small no-load losses. Large sizes, under uniformly distributed load, have higher no-load losses, but full-load losses are correspondingly reduced. Since their introduction in 1935, Davis Transformers have set new standards of safety, reliability and economy because of the experience behind them.

For Example,

the 100 KVA, 2400-120/240 volt transformer shown below has efficiencies of 98.4% at full load and 98.2% at ¼ load, while the 10 KVA, 7200-120/240 volt transformer has efficiencies of 97.2% at full load and 97.6% at ¼ load.



DAVIS 10 KVA, single phase, 7200-120/240 Volts, Oil-cooled

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For years we have been "transformer repair headquarters" for leading utilities and industrial companies. We offer complete repair and rebuilding service. All work guaranteed same as that of original manufacturer. A large stock of used transformers for sale — similarly guaranteed. Write us.

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To prepare them for good soldering, Sherman Lugs, after they are made, are first tumbled in sawdust. Then they go through a special acid cleaning bath (bright finish) which removes all traces of corrosion, dirt, grease or other foreign matter. After that, they are rigidly inspected to make sure that every individual lug is perfect.

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Split Bolt Connectors

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H. B. Sherman Mfg. Company
Battle Creek, Michigan

Write for Sherman Catalog!

oratory at Cambridge, Mass. He was graduated from Stanford in 1920, and he also holds a degree from the Massachusetts Institute of Technology.

▶ C. E. MURRAY, formerly vice-president, is now president of the Crescent Insulated Wire & Cable Co., Inc., Trenton, N. J. Mr. Murray is active in the National Electrical Manufacturers Association, being affiliated with the wire and cable division, the armored conductor and flexible metallic conduit section, the magnet wire section, the non-metallic sheathed cable section, the rubber sheathed cord and cable section, the rubber power cable section, the service entrance cable group there of, the building wire and cable section, the flexible cord and cord set section and the varnished cambric cable section.

▶ HENRY A. DINEGAR, formerly director of the Durable Goods Division of the Office of Civilian Requirements, has joined the American Steel Export Co. as manager of the electrical appliance division. Before joining OCR in 1941 he was managing director of the Carrier Corp.'s affiiate in Europe and the Near East.

▶ JACOB HUSSY, an operating engineer of the New Orleans Public Service Co., has not retired as was indicated in ELECTRICAL WORLD, December 9, page 113 when Mr. Hussy was one of the seven men honored by the Electrical Association of New Orleans with a golden anniversary certificate for having completed 50 years in electrical work in New Orleans.

OBITUARY

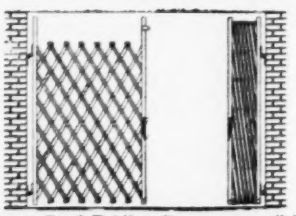
▶ CHESTER B. MYERS, purchasing agent of several utility companies in Iowa, died recently after completing 35 years of service. The companies included the Iowa Electric Light & Power Co., Iowa Electric Co., Central States Electric Co. and Northwestern Light & Power Co.

▶ ROBERT F. GIFFORD, 56, whose career embraced a wide variety of engineering activity in connection with power plant erection in Siberia, service with the General Fire Extinguisher Co., Providence, R. I., Stone & Webster Engineering Corp., Boston, the E. B. Badger Co., Cambridge, Mass., and others, died at Boston December 2.

▶ HARRY E. MILLER, 74, formerly general works manager of the Newark, N. J., plant of the Westinghouse Electric & Manufacturing Co., died recently at Arlington, Mass. He was well known in the field of electric meter engineering, in which he patented a number of improvements.

You don't need to take chances with unprotected property because Stewart Chain Link Wire Fence, Entrance Gates and other products are available *now* for certain protective purposes. If your product is essential to the war effort, you may qualify. So, tell us what you need and we will be glad to send complete information. The Stewart Iron Works Co., Inc., 1201 Stewart Block, Cincinnati 1, Ohio.

Stewart Wire Mesh Partitions for stock rooms, locker rooms, toolrooms, etc. When writing please give all measurements involved and state anchorage conditions.



Stewart Steel Folding Gates are available in single or double construction. For details and prices please send sketch indicating width and height of opening.

Stewart IRON and WIRE FENCES

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PROVIDING FOR UNEMPLOYED WORKERS in the TRANSITION

By RICHARD A. LESTER
Associate Professor of Economics, Duke University

154 pages, 5¾ x 8¼,
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Here is an important new volume in the Committee for Economic Development Research Study series, dealing with one of the most critical potential areas for postwar planning.

Shall conditions surrounding unemployment during industry's changeover period be permitted to start a downward spiral of curtailed spending, reduced production, and prolonged unemployment?

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The book outlines a comprehensive program — its steps, timing, and costs — for minimizing the effects of transition unemployment upon postwar production and job objectives.

"Presents in specific details a comprehensive clear-cut program which can do much to ease the transition from a war to a peace economy."

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"A major contribution toward the solution of one of our most important post-war problems. Should be widely read."

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GENERAL ELECTRIC

MANUFACTURING MARKETS

Synthetic Rubber Boom Seen Post-War

A "booming" post-war synthetic rubber industry is foreseen by Dr. John T. Blake, director of research of the Simplex Wire & Cable Co., Cambridge, Mass., in a survey of "Past, Present and Future of Synthetic Rubber", reported to the Northeastern Section of the American Chemical Society.

"I do not believe that natural rubber will be a free commodity for four or five years, even though our supplies increase appreciably," said Dr. Blake. "This supply will be under allocation by Washington to be used where it is definitely superior to synthetic rubber. The industry has four or five years in which to make good. By this I mean the production of material which will serve as a general purpose synthetic. . . . When we see the amazing technical improvements that have occurred in this period of time I have hopes that in the four or five years allotted to it without competition all this may be accomplished.

"The products that will be made from synthetic rubber several years from now will be far better in quality as a result of the advances in these various directions. Whether those products will be better than can be made from natural rubber remains to be seen, but I am sure they will be but little inferior and there is a good chance that they may be superior."

•

G.E. Orders Advanced 18 Percent in '44

Orders received by the General Electric Co. during the year 1944 amounted to $1,609,636,000, an increase of 18 percent over the total of $1,360,643,000 for 1943.

During the first and second quarters of 1944, new orders decreased 7 percent and 19 percent respectively, but in the fourth quarter they advanced 221 percent over the corresponding period of 1943.

"The large volume of new business booked during the fourth quarter of 1944 was the result of increased demands by the armed services for special types of war equipment being produced by General Electric," Charles E. Wilson, president, stated.

MOST POWERFUL MOBILE AIRPORT LIGHT FOR ALLIED FLIERS—This self-powered mobile airport lighting unit can light up a mile-long landing strip. Each of the four lights contains a 3,000-watt airport floodlight developed by Westinghouse Electric & Manufacturing Co. Electric power is generated through a power take-off designed by the Davey Compressor Co. which assembled the unit

WLB Approves Clauses of Westinghouse Contract

Approval by the War Labor Board of four contract provisions between the Westinghouse Electric & Manufacturing Co. and the Federation of Westinghouse Independent Salaried Unions has been announced by the union.

The issues, which have been before the Board since September, are: Vacation pay plan extended to 400 night employees previously denied its benefits; extra compensation allowed for salaried employees acting as group leaders; time and one-half approved for work on the sixth and seventh days of a work week even though the employee is absent earlier in the week if the absence is for one of the eight involuntary reasons defined in the contract; and overtime for all hours in excess of eight in one day or 40 in one week.

•

Taylor Tubes Licensed by General Electric Co.

A license to manufacture grid-controlled rectifier tubes has been extended to Taylor Tubes, Inc., Chicago, by General Electric Co. With the receipt of this license, and the RCA license previously, Taylor Tubes expects to widen the range of its tube line far beyond the scope it had pre-war, Rex L. Munger, sales manager, has announced.

Two tubes have been placed into immediate production as a result of the receipt of the G.E. license. They are the Taylor TT-17 and the Taylor 873.

•

Makes Retail Credit Survey

A retail credit survey will be conducted again by the Federal Reserve System to cover retail operations of 1944. Forms for use in reporting the information are being mailed this month. Retailers throughout the country have been cooperating in a similar survey each year since 1930, first with the Department of Commerce and for the past three years with the Federal Reserve Bank and the Federal Reserve Board.

•

Must Withdraw Recognition

Western Electric Co. has dominated and controlled the Point Breeze, Maryland, Employees' Association to such an extent that company recognition of the union must be withdrawn, the Fourth United States Circuit Court of Appeals has ruled in a recent 2 to 1 decision.

Manufacturers Make Sales Assignments

Electrical manufacturers have recently made the following assignments to their sales staffs:

A. B. Chance Co. has appointed Bruce Lobdill to work out of the company's Chicago office with their veteran salesman, C. L. Clark, a district sales manager. Mr. Lobdill will work with public utilities in Illinois, Ohio, Indiana, Kentucky and Michigan.

Trumbull Electric Mfg. Co. has appointed Leonard S. Poffinbarger as a field representative in the Chicago district.

Benjamin Electric Mfg. Co. has transferred A. E. Swedenborg to the Chicago office to cover industrial plants, architects and consulting engineers. He was formerly field engineer in the Michigan territory with headquarters in Detroit. C. H. Pollack, who has been field engineer in New York City, has been placed in charge of the Buffalo territory. R. J. Mors has been appointed field engineer, working out of the Chicago office.

Cardox Corp., Fire Division, has named J. H. Krallmann district manager for the territory including eastern New York state, northern New Jersey and all of New England. William C. Powell has been named to succeed Mr. Krallmann. He has been district engineer for the Illinois, northwestern Indiana and Wisconsin area, with headquarters in Chicago. Goodwin Roberts will take over the responsibilities of district engineer of this section in association with J. W. Long, the district manager. Arthur Espey has joined Cardox Fire Division as district engineer for the territory embracing Pennsylvania, Delaware, Maryland, West Virginia, western New York and southern New Jersey. In this territory Mr. Espey will work with F. C. Rodgers, district manager.

•

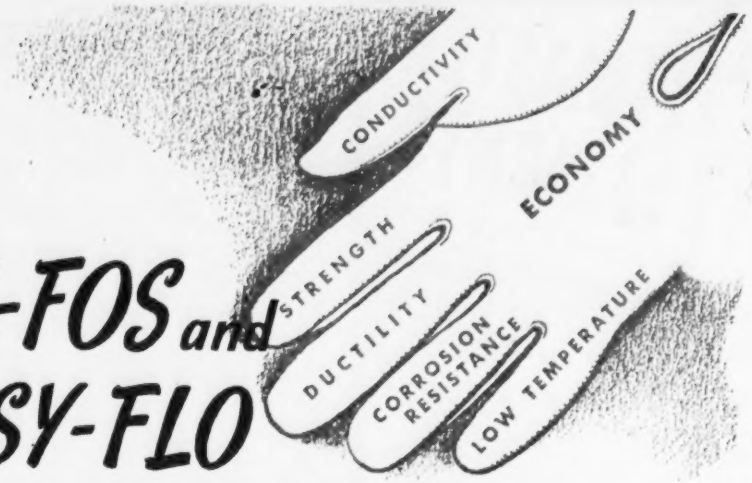
Cutler-Hammer Refund

Cutler-Hammer, Inc., has reached an agreement with the Government on renegotiation of 1943 war contracts. Total excess profits, according to the company, were $5,232,952, and the net refund to the Government was $1,020,331, after allowance for taxes. Effect of the settlement was a charge of $359,848 against income for the year, after giving effect to a reserve of $1,000,000 set up from 1943 profits. The post-war refund of excess profits taxes showed an adjustment of $388,515 as a result of the settlement.

•

Reports Lower Net in 1943

Net profit of the Rome Cable Corp. for the nine months to December 31, after $1,715,100 taxes, was $402,662, or $2.12 a share, against $426,112, or $2.24 a share, after $1,513,569 taxes, for nine months to Dec. 31, 1943. Net profit for the December quarter totaled $144,040, or 76 cents a share, against $125,069, or 66 cents a share, for the corresponding quarter of 1943.



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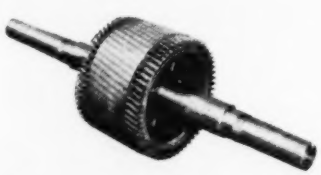
fit the Electrical Industry's brazing needs like a glove

In mounting spuds and fabricating this chassis of an important piece of electronic equipment, EASY-FLO brazing gives high production at low cost.



Every property needed in the joints between rotor bars and end rings of this rotor is provided by SIL-FOS brazing.

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Ability to stand up in service is a prime requirement . . . SIL-FOS and EASY-FLO joints have the ductility to withstand severe vibration, shock and temperature changes.

Corrosion resistance is important . . . SIL-FOS and EASY-FLO joints offer high resistance to most corrosive agents.

In vast numbers of joints, the metals joined are of light gauge. The low working temperatures of SIL-FOS and EASY-FLO (1300° and 1175° F) minimize the possibility of heat damage.

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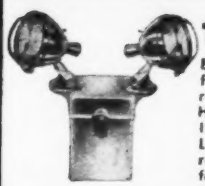
A lightweight hand light (250,000 c.p.) concentrated searchlight beam. Penetrates smoke, fog, steam. Range one mile. Rechargeable, corrosion-proof, spill-proof battery.



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Emergency dual head floodlight for control rooms and key positions. Has long life battery. Illuminates wide area. Lights automatically when regular 115 volt circuit fails.

The Super 6

A powerful, penetrating beam, 6 volt 21 amp. hour, semi-non spillable rechargeable battery. Provides long burning low power consumption service light or brilliant 250,000 cp searchlight (range 1 mile).

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Roof Searchlight. Inside Pistol Grip Control. Range one-mile. Most powerful automobile spotlight made. Swings in a complete circle, any angle, up or down. Penetrates fog or smoke. Operates from car battery.

● How quickly your night repair crews are able to end outages depends upon how well they're able to see. 70 Carpenter Masterlights are available to help them speed up night repairs . . . and maintain your customer goodwill.

No more needless groping about in the dark. Types available include worklights, searchlights, floodlights, warning lights, patrol lights, watchmen's lights, and emergency lights for all conditions. 30-day free trial, without any obligation. Send for descriptive literature.

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Field Reports on Business

Increasing numbers and sizes of orders for war material are sustaining the electrical market at a high level. Switch and control apparatus, power regulation apparatus and conduit are outstanding among current demands. Bidding on Navy supply schedules is active. Retail trade continues above last year's figures.

PACIFIC COAST

Total value of December building permits for the seven western states showed 3 percent decrease from Novmber and 45 percent decrease from December, 1943. Overall value for 1943 was $216,137,563; for 1944 was $210,878,389, a decrease of only 2½ percent. However, electrical contractors are generally busy, especially in the navy yard and depot areas of Washington and California, with many sizable jobs for additional and revised wiring, rising to a peak is such awards as $373,000 and $175,000 at Terminal Island and San Diego. Reconversion of Kaiser's No. 3 Richmond yard to a repair yard and much new work at Hunters Point, San Francisco, provide other large electrical construction. Much scattered work results from hospital call and fire alarm systems, the latter being installed in various government locations.

Prospective machinery orders include bridge cranes for San Pedro; bus structures, switch panels, and auxiliary system for an Oakland pumping plant and a temporary plant for Post Falls unit of Rathdrum project, Idaho. A shipyard has placed a million dollar order for switchboards, motors, and controls.

At Hunters Point, San Francisco, industrial developments are especially active, including additions to General Cable's plant in Emeryville; a Jorgenson steel addition in San Francisco; $700,000 new construction covering offices, warehouses, and assemblies at Ryan Aeronautical Co.'s San Diego plant; and $650,000 of additions and reconversions for General Motors at South Gate near Los Angeles.

CHICAGO

Central Illinois Electric & Gas Co., Rockford, is expected to begin work soon on the superstructure for an addition to its local generating station. The project, which is reported to have a priority rating, is said to invlove a turbine and additional equipment. Cost of the project has not been disclosed.

To the west, Interstate Power Co., Dubuque, has applied for permission to extend its 2,300 volt primary distribution lines. Work will start when project permission has been granted, it is reported.

Monsanto Chemical, St. Louis, plans expansion in plant for production of sulfuric acid for the government. Cost is given as around $750,000 with machinery and electrical equipment. The project involves several one-story buildings, and equipment for increased production.

Bay City, Mich., electric light department has post-war plans in progress for extensions and improvements in municipal distribution system, involving overhead and underground lines, and substation facilities. The projected program calls for expenditure of about $175,000.

Construction of war housing increased more than 1,100 units in the Chicago area last year, representing a rise in building expenditures of better than $2,600,000 a survey by Bell Savings & Loan Association shows. In all 8,644 residential units were erected during 1944 at a cost of $33,413,749. Despite this pickup in war housing, however, total building activity of all types dropped $32,500,000 last year due largely to a decline in the construction of big war plants. Value of all classes of construction in the Chicago district during 1944 was $76,842,110 against $109,350,095 in 1943, it was reported.

NEW ENGLAND

The electrical market is being sustained at an encouraging level of activity by increasing numbers and sizes of orders for war material. Ignition assemblies, switch and control apparatus, and power regulation apparatus, conduit, and friction tape bookings were larger during the past fortnight. Aircord Co., Worcester, Mass., has been awarded a DFC contract amounting to $33,000 for new equipment. Gould Aeronautical Division, Pratt, Read & Co., Inc., Deep River, Conn., have received a contract to build several hundred more gliders for the U. S. Army. Boston & Maine R.R. has installed a new electric interlocking signal light and switch central system at its yards in Manchester, N. H.

Tightening of WPB regulations regarding civilian production may effect the machine tool business in this district. Bidding on Navy supply schedules is active and ASO awards in this district during the past week were encouraging. Bids on over 100,000 rolls of friction tape were placed; capacitors are in demand again, and radar supplies continue to be 'urgent" requirements.

American Brass Co. received Navy orders for $40,000 worth of brass conduit, and Pratt & Whitney Aircraft Corp., East Hartford, Conn., has been commissioned to carry out special assignments at a cost of $500,000. Oil-cooling assemblies, plastic receptacles, machine spare parts, bearings and ignition assemblies were bought from Connecticut manufacturers last week.

General Radio strobotacs, B. F. Sturtevant blowers, and large amounts of wiring supplies featured Massachusetts bids. Subcontractors are taking on increasing numbers of wiring contracts from manufacturers of complicated electrically operated assemblies.

NEW YORK

While substantial gains have been made in the war output program, sharp increases in many major items will have to be achieved to meet schedules. The war production program as a whole for 1945 has been raised from an original estimate of $56.5 billion to $64.5 billion, according to the War Production Board. The manpower situation is at present a challenging issue.

Civil engineering construction volume in continental United States totaled $8,791,000 last week. This volume was the lowest weekly total reported since July 6, 1933. It was 68 percent under the preceding week and 74 percent below the volume for the corresponding 1944 week. The week's volume brought 1945 construction to $88,193,000 for the four-week period, a decrease of 44 percent from the $156,518,000 for the four weeks of 1944.

Retail trade continued active in the Metropolitan area last week, in spite of weather conditions. In fact low temperatures spurred the demand for cold-weather merchandise. Estimates put department store volume at about 5 percent ahead of the similar period of 1944.

Sales Opportunities

KENTUCKY—Kentucky & West Virginia Power Co., Ashland, plans extensions in primary and secondary lines for rural electric system, including line transformers, service connections and other operating facilities. Project will comprise about 150 line additions. Permission has been secured and work is scheduled to be placed under way soon. Cost of project estimated close to $2,100,000.

OHIO—Goodyear Tire & Rubber Co., 1144 East Market St., Akron, will make extensions in plant for manufacture of heavy-duty truck tires for military vehicles for government, with installation of machinery and electrical equipment. Cost estimated about $500,000, with financing by Defense Plant Corporation. Proposed to begin work at early date.

WISCONSIN—Municipal Light and Power Department, Gresham, will receive bids until February 19 for extensions in municipal hydroelectric generating station, including installation of new hydraulic turbine, generator, switching equipment and miscellaneous equipment. Project is understood to have a priority rating. Orbison & Obison, 206 West College Ave., Appleton, are consulting engineers.

PENNSYLVANIA—Edward G. Budd Mfg. Co., 2450 Hunting Park Ave., Philadelphia, manufacturer of automobile bodies, steel stampings, etc., now in production for government, has contracted with Philadelphia Ordnance District for manufacture of quantity of artillery shell fuses, and will give over about 150,000 sq. ft. in plant to this output. Additional machinery and electrical equipment will be installed for parts division and assembling lines, estimated to cost approximately $5,000,000. It is understood that financing will be provided by government. Proposed to have plant ready for service in June.

WASHINGTON—Washington Water Power Co., Spokane, plans extensions in transmission line close to 20 miles. A power substation will be located at line terminus for power distribution. A priority rating has been secured and work will be placed under way soon.

CALIFORNIA—Imperial Irrigation District, Imperial, plans extensions and improvements in transmission and distributing lines including additions to power substations and switching stations, and other operating facilities. Program will be carried out as a post-war development and is estimated to cost approximately $1,000,000. Organization also has arranged for fund of $5,500,000 for proposed new hydroelectric generating station to be known as Pilot Knob power plant. It will be equipped for initial rating of about 30,000 kw. Project will include construction of a 154,000-volt transmission line, approximately 33 miles long, with switching station and other operating facilities. It is understood that this latter project will have a priority rating.

TEXAS—Jefferson Chemical Co., Port Arthur, care of Texas Co., Port Arthur, plans new plant for manufacture of special chemical products, utilizing waste oil as main source of raw material. It will comprise several one and multi-story buildings for processing and general production, with machinery and electrical equipment. A power substation will be built, with several

A HOIST TO FIT THE JOB

This Signal Corps picture, taken somewhere in France, shows U. S. Army Engineers using a Coffing "Safety-Pull" hoist in the construction of a treadway bridge.

Every day brings the war nearer to a successful conclusion and Coffing Hoists are doing their part, both on the war front and the home front.

Whether in mills, factories, mines, utilities, oil fields, construction, production or maintenance there is a Coffing Hoist that will help you do the job faster, better and more economically. Write for Catalog No. E-G-6.

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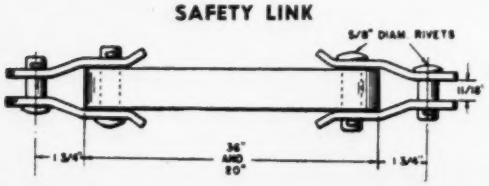
#4 *in a series of informative news letters from a producer of Power Switching Equipment.*

Among superintendents and engineers in charge of transmission and distribution systems we have something of a reputation for being receptive to practical suggestions from the field. At least that's the reputation we want and have tried hard to acquire. Sometimes a product of remarkable value to our customers is born this way. The safety link on page 112 of our catalog* is a good example. This is an invention of Arthur O. Austin, of Barberton, Ohio, consulting engineer for Royal Electric. We had nothing whatever to do with its design. But we did have sense enough to know a good thing when we saw it and were not caught out with a fork, so to speak, when it was raining soup. We took over this safety link in a hurry and there are thousands in service today.

SAFETY LINK



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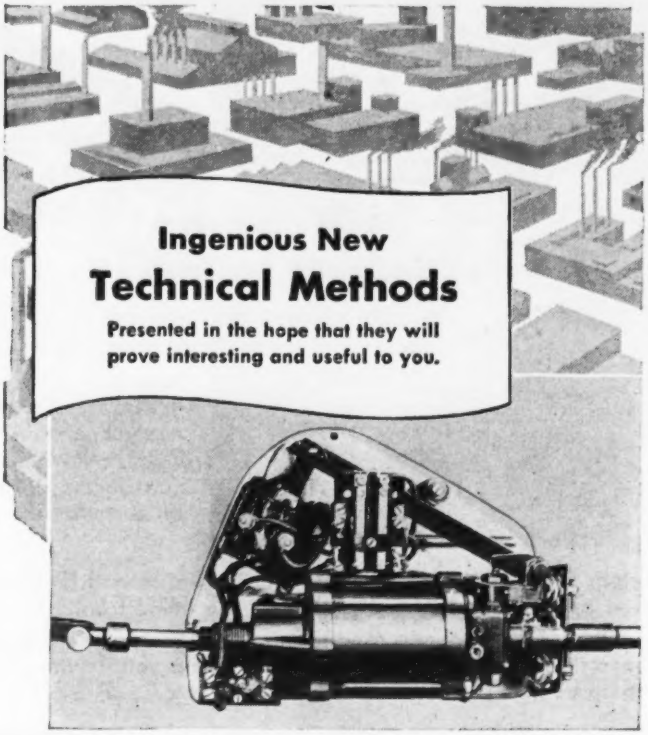
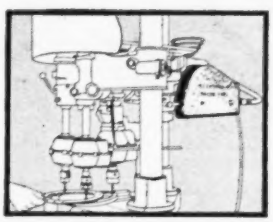


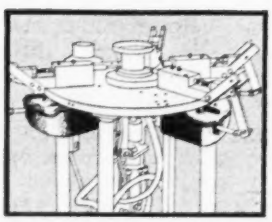
New Electroaire Power Unit Converts Standard Drill Press to Automatic

This exact control over feed and retraction speeds permits ready conversion of a standard drill press with tapping head into an automatic tapping machine, capable of producing Class III threads, even with comparatively unskilled operators. By adjusting speed to conform to the lead pitch of the threads being tapped, the tap will cut without forcing threads, and on the reverse the tap will actually "float" out of the part with no strain against the thread angle.

Air-powered jigs and fixtures can be opened, closed, and indexed by the Electroaire Power Feed. The unit can be set for a pre-determined number of cycles so that multiple holes can be drilled in the same piece without ejection, by means of an indexing fixture controlled and synchronized by the Electroaire Unit. One operator can run as many as two or three drill presses, turning out top-quality work with few rejects and with a minimum of tool breakage, thus effecting a great savings in time.



Set up to punch 3 holes simultaneously



Shows holes being drilled automatically

Present stockpiles of finest quality materials used in the manufacture of Wrigley's Spearmint chewing gum are now exhausted—necessitating discontinuance of production. When a supply of proven materials—known to be up to the finest standards of quality—is again available, Wrigley's will resume production—And Wrigley's Spearmint will be back to again help you on your job. In the meantime they are manufacturing a war brand. Wholesome but not excellent enough for the Wrigley brand name.

You can get complete information from Electroline Manufacturing Company, 1975 East 61st Street, Cleveland 3, Ohio.

Z-55

transformer stations at different parts of works. Entire project is reported to cost over $10,000,000. Application has been made for a priority rating. Company was organized recently as a joint subsidiary of Texas Co., noted, and American Cyanamid & Chemical Co., 30 Rockefeller Plaza, New York, N. Y. It is understood that Chemical Construction Co., affiliated with last mentioned company, same address, will be engineer for project.

CALIFORNIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., is securing fund of $1,432,00 in new Navy Public Works bill, recently approved by Congress, for expansion at Navy Yard, including additional buildings and structures, with mechanical and electrical equipment. Also, fund of $43,420,000 for development of dry docks, likewise to include installation of considerable electrical and mechanical equipment. Bids will be asked for different branches of program at intervals in near future.

OREGON—Municipal Water and Light Department, McMinnville, plans extensions and improvements in street-lighting system as a post-war project, including installation of new electrolier units in different parts of municipality. Cost reported over $100,000.

TENNESSEE—Goodyear Tire & Rubber Co., 1144 East Market St., Akron, has contracted with government for construction and operation of new mill, comprising several large one and multi-story buildings for production of heavy-duty tires and tubes for military trucks and vehicles. Machinery and electrical equipment will be installed for initial rated output of about 3,000 tires daily. Plant will approximate 625,000 sq. ft. floor space. Power supply will be secured from TVA system, Nashville, with transmission line to be constructed to plant site, where power substation will be located for distribution service. Motor-generator sets will be installed, as well as transformer stations, control stations and other electrical facilities. Entire project is estimated to cost about $11,000,000, with financing by Defense Plant Corporation. J. Gordon Turnbull, Inc., 2630 Chester Ave., Cleveland, Ohio, is consulting engineer. Bids are scheduled to be asked soon.

CALIFORNIA—Department of Water and Power, 207 South Broadway, Los Angeles, plans new pumping station for water system in Buena Vista district, as a post-war project, with installation to include four motor-driven pumping units, one with rated output of 3,500 gal. per min., and other three, 700 gal. per min., with controls and other electrical apparatus. Entire project will cost about $140,000.

KANSAS—Water and Light Department, Herington, plans extensions and improvements in municipal power plant, with installation of additional equipment. Surveys and estimates of cost will be made by Burns & McDonnell Engineering Co., 107 West Linwood Blvd., Kansas City, Mo., consulting engineer. Application will be made for a priority rating.

ILLINOIS—Gar Wood Industries, Inc., 7924 Riopelle Ave., Detroit, Mich., manufacturer of automatic heating and air-conditioning systems, has plans for new one-story plant, about 100 by 600 ft., for production of certain war materials. Cost reported over $275,000, with machinery and electrical equipment. Project has a priority rating and work will be placed under way at early date. John A. Stromberg, 140 South Dearborn St., Chicago, is engineer.

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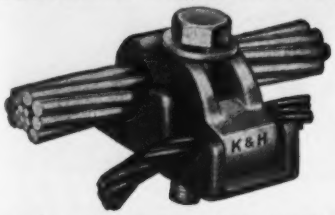

Effectively used as guy line ground, or transformer and lightning arrester connection to A. C. S. R. or copperweld conductors where the diameters may be from 8-A copperweld to .595" A. C. S. R. armour rods. Wire sizes .595" to 5/32".

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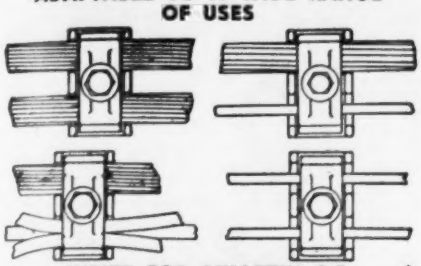

★ WRITE FOR BULLETIN 8-B ★

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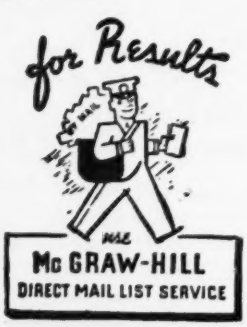

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Recent Rate Changes

ALABAMA POWER CO. has been ordered by the State Public Service Commission to reduce its rates in Choctaw County to effect a saving for 350 customers estimated at more than $8,800 a year.

OKLAHOMA GAS & ELECTRIC CO. has been ordered by the State Corporation Commission to put into effect an annual reduction of $23,787 in the preferential electric rate for rural electric cooperatives serving rural subscribers and small communities. The cooperatives want the preferential rates on electricity bought from Oklahoma Gas & Electric Co., regardless of the size of the town served, and the utility company wants to confine it to small communities. The order of the commission, following contested arguments before it, provided that the preferential rate of 8 mills a kilowatt-hour be reduced to about 6 mills, with limitation for the rate to farm users and communities of less than 125 customers, which Reford Bond, chairman of the commission, estimated would mean communities of population of less than 600 persons. It also provided the limited rate for non-farm users up to 30 kva. of transformer capacity. Chairman Bond said the object was to confine the preferential rate to farm users and small communities.

CHESTER LIGHT & POWER CO., Chester, Nova Scotia, has been ordered by the Nova Scotia Public Utilities Board to reduce electricity costs to customers by approximately $7,000 for 1945.

FOREST GROVE (Ore.) municipal plant's small residential light patrons and commercial customers have benefitted by a reduction in electric rates, effective February 1. The proposed schedule is 2½ cents per kilowatt-hour on the first 50 kw.-hr.; a reduction of ½ cent under the old rates; 2 cents for the second 50 kw.-hr.; one cent for the next 150 kw.-hr. and ½ cent for the next 750 kw.-hr. All over 1,000 kw.-hr. costs ¾ cents per kilowatt-hour. Minimum is 75 cents. Commercial rates give the consumer 150 kw.-hr. for 2½ cents per kilowatt-hour; the next 300 kw.-hr., 1½ cents. The final step on the schedule is excess above 100,000 kw.-hr. at 3 mills. At the present light rates, the city has accumulated more than $100,000 in bonds to finance improvement of the electric distribution system in the post-war period.

NORTHERN INDIANA PUBLIC SERVICE CO. has filed a revised electric rate schedule with the state Public Service Commission which would result in an annual saving of approximately $46,250 to residents in the Michigan City, Ind., area. The schedule applies to residential and commercial service in Michigan City, Long Beach, Duneland Beach, Potawatomi Park and Trail Creek. Rates will become effective on billings on and after February 1.

Energy Production Down

Electric energy produced for public use in November, 1944, totaled 18,888,508,000 kw.-hr., a decrease of 1.7 percent as compared with November, 1943, according to a report issued by the Federal Power Commission. Average daily production of electric energy for public use in November was 672,189,000 kw.-hr., an increase of 2.1 percent when compared with the average daily production in October.

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REA Allots Funds; Approves Contracts

The Rural Electrification Administration recently approved loan allotments totaling $1,010,000 to eighteen co-ops in twelve states, bringing total REA allotments to $519,593,301, of which $20,713,500 represents operations during the current fiscal year.

The loans which include the following, will provide for the extension of electric service to farms located near existing lines. No construction will be undertaken which does not meet with the approval of the War Production Board.

GEORGIA—Habersham Electric Membership Corp., Clarkesville, $50,000.

INDIANA—Bartholomew County Rural Electric Membership Corp., Columbus, $15,000.

KANSAS—P.R.&W. Electric Cooperative Assn., Inc., Wamego, $50,000.

MISSISSIPPI — Southern Pine Electric Power Assn., Taylorsville, $150,000; Delta Electric Power Assn., Greenwood, $100,000; Coahoma Electric Power Assn., Clarksdale, $50,000; Capital Electric Power Assn., Clinton, $50,000; Singing River Electric Power Assn., Lucedale, $20,000.

MISSOURI—Grundy Electric Cooperative, Inc., Trenton, $80,000.

NEW MEXICO—Stonewall Electric Co., (231 W. Main St., Trinidad, Colo.), $10,000.

OHIO—Tri-County Rural Electric Cooperative, Inc., Napoleon, $40,000, including $16,000 for construction of a substation.

OKLAHOMA—Alfalfa Electric Cooperative, Inc., Cherokee, $50,000.

SOUTH CAROLINA—Santee Electric Cooperative, Inc., Kingstree, $55,000; Mid-Carolina Electric Cooperative, Inc., Lexington, $40,000.

TEXAS—San Patricio Electric Cooperative, Inc., Sinton, $75,000; Deep East Texas Electric Cooperative, Inc., San Augustine, $50,000.

WISCONSIN—Clark Electric Cooperative, Greenwood, $115,000.

WYOMING—Riverton Valley Electric Assn., Inc., Riverton, $10,000.

Construction contracts recently approved include the following:

ALABAMA—Tombigbee Electric Cooperative, Sulligent, contract to Stuart C. Irby Co., Jackson, Miss., 450.6 miles of line; labor and materials, $342,360.

ARKANSAS—South Central Arkansas Electric Cooperative, Inc., Arkadelphia, contract to Harvill-Byrd Electric Co., Little Rock, Ark., 50 miles of line; labor and materials, $53,508.

ILLINOIS—Illinois Rural Electric Co., Winchester, contract to L. E. Myers Co., Chicago, Ill., construction of 3 miles and conversion of 7.1 miles of line; labor only, $7,079.

KANSAS—Sekan Electric Cooperative Assn., Girard, contract to Platte Valley Electric Construction Co., Littleton, Colo., 49.1 miles of line; labor only, $23,045.

LOUISIANA—Valley Electric Membership Corp., Natchitoches, contract to Delta Construction Co., Clarksdale, Miss., 21.6 miles of line; labor and materials, $19,329.

MISSISSIPPI—Southwest Mississippi Electric Power Assn., Lorman, contract to Line Construction Co., Clarksdale, Miss., rephasing work on 18.95 miles of line; $4,022. Four-County Electric Power Assn., Columbus, contract to Stuart C. Irby Co., Jackson,

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Miss., 17 miles of line; labor only, $4,518.

MISSOURI—Laclede Electric Cooperative, Lebanon, contract to Killoran Electric Co., Appleton, Wis., 46 miles of line; labor and materials, $49,435.

NORTH CAROLINA—French Broad Electric Membership Corp., Marshall, contract to Hobbs-Peabody Construction Co., Charlotte, N. C., repairs to dam at hydro-generating plant; $1,350.

OREGON—Blachly-Lane County Cooperative Electric Assn., Blachly, contract to L. H. Leonard Electric Construction Co., San Rafael, Calif., 15 miles of line; labor and materials, $17,082. Douglas Electric Cooperative, Roseburg, contract to Tice Electric Co., Portland, Ore., 43 miles of line; labor and materials, $121,416.

SOUTH CAROLINA—Berkeley Electric Cooperative, Inc., Moncks Corner, contract to Allied Electrical Constructors, Charleston, S. C., construction of 1½ miles and rephasing on 4½ miles of line; labor only, $849.

TEXAS—Dickens County Electric Cooperative, Inc., Spur, contract to Eugene Ashe Electric Co., Fort Worth, Texas, 75 miles of line; labor and materials, $57,629.

WISCONSIN—Marathon-Portage Electric Cooperative, Inc., Wausau, contract to A. A. Electric Co., Cicero, Ill., 121.3 miles of line; labor and materials, $131,942.

•

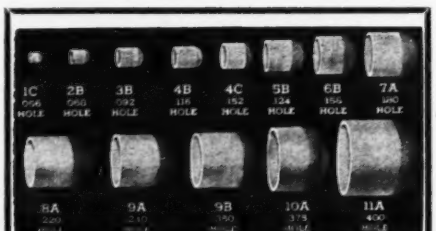
Sees Big Radio Trade-In

More than five out of every ten persons who will replace old sets with new ones when radios come back on the market, expect to make trade-ins on them, Don G. Mitchell, vice-president of Sylvania Electric Products, Inc., disclosed at a distribution clinic held recently. Market researchers found that two-thirds of all the people who buy a radio will be replacing an old set, and that more than 50 percent of those will expect the dealer to take in the old one.

•

Elliott Co. Makes Refund

Elliott Co., Jeanette, Pa., has announced that it has completed renegotiation proceedings with respect to government contracts completed in 1943 and has made a net refund to the government of $35,690 in settlement.



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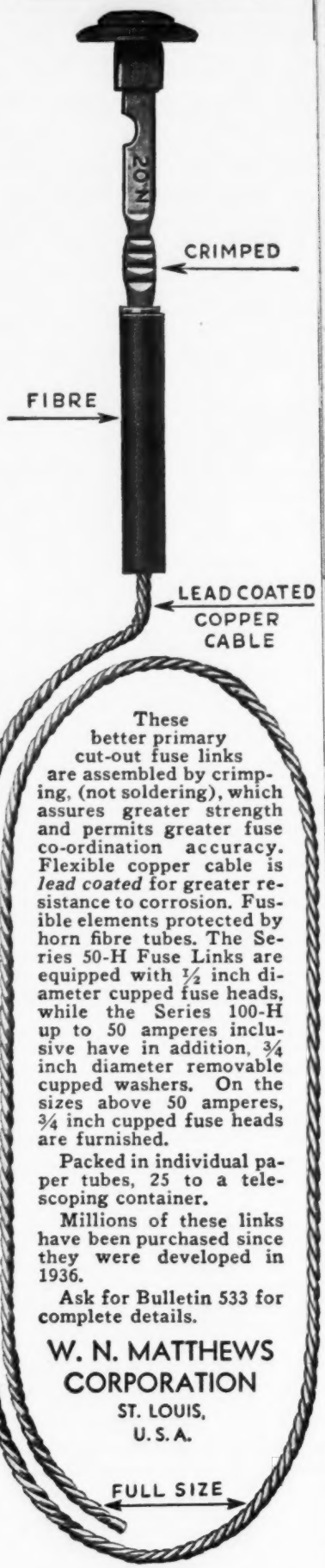

These better primary cut-out fuse links are assembled by crimping, (not soldering), which assures greater strength and permits greater fuse co-ordination accuracy. Flexible copper cable is *lead coated* for greater resistance to corrosion. Fusible elements protected by horn fibre tubes. The Series 50-H Fuse Links are equipped with ½ inch diameter cupped fuse heads, while the Series 100-H up to 50 amperes inclusive have in addition, ¾ inch diameter removable cupped washers. On the sizes above 50 amperes, ¾ inch cupped fuse heads are furnished.

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WMC Regulations Prevail

P-806, Electrical World
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Write Supervisor of Technical Employment for application, 306 Fourth Avenue, Pittsburgh, Pennsylvania.

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& MANUFACTURING COMPANY

★ U.S. NAVY ★

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These surplus motors are D.C., shunt wound, 3500 R.P.M. Temperature rise stabilized at 55°C. Rated at ¾ H.P. for continuous duty; 1 H.P. for varying duty. Waterproof.

40 Motors—115 V., 9.6 Amp.
41 Motors—230 V., 4.8 Amp.

Mfd. by Electro Dynamic Works, Bayonne, New Jersey

SEALED BIDS

will be accepted until 10:00 A.M. (EWT) Wednesday, Feb. 21, 1945.

For information how to purchase these motors, contact

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REDISTRIBUTION & DISPOSAL OFFICE
342 Madison Avenue — New York 17, N. Y.
Requesting Sales Catalog No. B-85-45W.

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Excellent position is available for technical editor and writer. Man must have thorough knowledge of principles of electrical engineering. Should have facility as a writer and be able to review and to analyze critically the writings of others on engineering subjects. This is a permanent position and offers excellent opportunity to a man with imagination, good engineering background, and writing ability. Starting salary $3600. for applicant who in our judgment fully meets our requirements. Write Supervisor, Technical Employment, 306 Fourth Avenue Pittsburgh, Pennsylvania.

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& MANUFACTURING CO.

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Mechanical and electrical. Graduate or equivalent training. Required for development work in the following branches:

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2. Measuring and control instruments. Background should be in electrical engineering, including electronics.

Statement of Availability Required.

P-805, Electrical World
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Mechanical electrical, experienced in design layout, research, and testing. Transmission and distribution equipment. Permanent. Applicant must have good technical background. State details of education, experience, draft status, age and availability. Send photo with application and state salary expected. Address reply to:

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210 North Allen St., Centralia, Mo.

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Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

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1—1250	G.E.	720	250	2300
1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000
1— 500	G.E.	1200	600	13200/2300

Rotary Converters—3 Ph. 25 Cy.

2—1500	G.E.	500	225/275	6600
1— 500	G.E.	750	225/275	6600

M. G. Sets—3 Ph. 60 Cy.

1—1500	G.E.	360	250	2300/4600
1—1000	G.E.	720	250	2300/4150
1— 500	G.E.	900	250	440/2300
1— 500	G.E.	720	600	13200
1— 400	G.E.	720	250	2300

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MOTOR

30 H.P. Star Electric motor style SY-504, ballbearing, serial #231362, 220-440 volt, 3 phase, 60 cycles, 685 R.P.M., Cutler Hammer variable speed controls.

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Offered Subject to Prior Sale

300 H.P. McIntosh-Seymour Diesel Electric Generating unit, 3 Cyl., 4 Cycle air injection Direct Connected to G.E. Type TRE, Form D.S. Generator, 2300 volts, 3 phase, 60 cycle, also direct connected exciter. Immediately available in Central Kansas.

165 H.P. Busch Sulzer Diesel Electric Generating Unit, 4 Cyl., 4 Cycle air injection Direct connected to G.E. Type TRE generator, 3 phase, 60 cycle, 2300 volts. Shaft extension for exciter, but no exciter. Immediately available in Southwestern Kansas.

E. M. PATCHEN, *Purchasing Agent*
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Great Bend, Kansas

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ARC LAMPS

Overhead hanging outdoor type street arc lights wanted for a museum. State name plate data, condition and price.

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Experienced stripping contractor having, due to exhaustion of present mine, organization and equipment available, desires to produce strip coal and deliver on railroad cars or truck to plant storage pile for utility company or large industrial consumer, thereby insuring it low-cost dependable fuel supply. Will enter into long-term contract and furnish highest references.

WW-807, Electrical World
520 North Michigan Ave., Chicago 11, Ill.

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT
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N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTORS

3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—350 HP, 300 RPM, 440 volt, G.E. slip ring
1—225 HP, 1800 RPM, 220 volt, G.E. slip ring
1—200 HP, 600 RPM, 440 volt, Crocker Wheeler slip ring
1—200 HP, 600 RPM, 2200 volt G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E. sq. cg.
2—150 HP, 1200 RPM, Westinghouse, squirrel cage
2—150 HP, 1800 RPM, 220 volt, Westinghouse slip ring
1—100 H.P. 1800 R.P.M. 440 volt, General Electric, squirrel cage
1—60 H.P. 1200 R.P.M. 2200 volt, General Electric, slip-ring

D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—150 HP, 500 RPM, General Electric, MPC.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 575 RPM, General Electric
3— 50 HP, 700 RPM, Crocker-Wheeler

VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electric Dynamic.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker-Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
2—25 HP, 650/2200 RPM, Westinghouse.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—10 HP, 400/1600 RPM, Westinghouse, SK.
1— 5 HP, 450/1800 RPM, Crocker-Wheeler.

MOTOR GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, Synchronous.
1— 75 KW, 125 volt, General-Electric, squirrel cage.

TRANSFORMERS

2—400 KVA, G.E. 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh 7800/440 volt.
3—200 KVA, Allis-Chalmers, 2200/220/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
4—150 KVA, G.E., 2400/240/480.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110.
2— 75 KVA, General Electric 3 phase, 4150 Y, 120/208Y.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 250 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—30 KW, 125 volt, Allis Chalmers.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

—TRANSFORMERS—

BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

LOCOMOTIVES

8-Ton Whitcomb gasoline 36" gauge.
15-Ton Porter saddle tank 36" gauge.
20-Ton Whitcomb Diesel 36" gauge.
21-Ton Porter saddle tank 36" gauge.
30-Ton Vulcan saddle tank 56½" gauge.
67-Ton American six-wheel switcher.
85-Ton Baldwin saddle tank 2-8-2. Oil fuel.

CARS

2—Western Air dump cars, 30 yd. cap.
14—All-steel 50-Ton Gondolas. Immediate delivery.
19—Flat cars, 50 tons capacity. Rebuilt.
40—Hopper cars, 50 tons capacity.
1—Class III tank car, 10,000 gal. cap.
40—Class III tank cars, 8,000-gal. cap.
8—Class II tank cars, 8,000-gal. cap.
5—Class IV tank cars—Lined.

LOCOMOTIVE CRANES

20-Ton Link-Belt electric.
22½-Ton McMyler-Interstate. Steam.
25-Ton Browning. Steam.
10-Ton Industrial-Brownhoist. Gasoline.

GASOLINE CRAWLER CRANES

1—Universal, 32 ft. boom. Caterpillar.
1—P & H 600, 60 ft. boom shovel front and dragline.
1—Byers Bearcat 30 ft. boom, ¾ swing.

GASOLINE TRACTORS

2—Allis-Chalmers Model K (one with blade; one without).
1—Caterpillar Model D-35, with blade.
1—Cletrac 40-30, with blade.

THE HARVEY LEFEVRE CO.
500 Fifth Ave., New York 18, N. Y.
Telephone PEnnsylvania 6-3175

FREQUENCY CHANGER

1000 KW, 460 volts, 3 phase, 25 cycle,
300 RPM, 1570 amperes, serial 4,900,000,
1250 KVA 0.8 p.f. 50-deg. rise General Electric, type ATI-10-1250M-300, with amortisseur winding, with 33 KW disconnected exciter, with
1400 HP 460 volt, 3 phase, 60 cycle,
300 RPM General Electric, 1570 ampere,
1250 KVA p.f. 0.9, 50-deg. type ATI-24-1250M-300 form C, with amortisseur winding.

CHICAGO ELECTRIC CO.
1314 W. Cermak Rd. Chicago, Ill.

ADVERTISING IN THIS ISSUE

Acme Electric & Mfg. Co., The... 152
*Adam Electric Co., Frank..... 41
*Allen-Bradley Company 19, 20
*Allis-Chalmers Mfg. Co.....10, 11
Aluminum Co. of America..... 49
*American Brass Company, The.... 121
American Cyanamid Co., The..... 18
American Tel. & Tel. Co..... 66
*American Transformer Co..... 13

Bakelite Corporation 59
*Bentley, Harris Mfg. Company.... 67
*Biddle Company, James G..... 58
Bristol Company, The..... 52
Buckeye Laboratories Corp., The.. 38
*Burndy Engineering Co., Inc..... 16

*Carpenter Mfg. Co..... 148
Chase Brass & Copper Company... 60
Coffing Hoist Company..... 149
*Continental-Diamond Fibre Co.... 62
Crescent Insulated Wire & Cable Co. 134
Crouse-Hinds Company 39

Davis Transformer Company..... 143
Directory of Engineers..... 154
*Dow Chemical Co., The..... 29
*Dow Corning Corp..... 111
Driver-Harris Co. 47

Electric Controller & Mfg. Co., The 28
Electroline Company 5
Elliott Company 6
Engineers, Directory of..... 154
*Everstick Anchor Co..... 152

*Fairbanks, Morse & Co..... 50
Federal Electric Products Co., Inc. 122
*Formica Insulation Co., The..... 26
*Four Wheel Drive Auto Company 55
Frigidaire, Div. of General Motors 129

G & W Electric Specialty Co..... 36
General Cable Corp.....24, 25
*General Electric Co.....103, 104, 105 107, 135, 145
General Electric Co., Air Conditioning & Comm. Ref. Divs..... 64
General Luminescent Corp..... 125
Gould Storage Battery Corp..... 22
*Greenlee Tool Company..... 120

Handy & Harman..... 147
*Hazard Insulated Wire Works..... 4
*Heinemann Circuit Breaker Company 61
Hendy Iron Works, Joshua..... 109
Hi-Voltage Equipment Co..... 118

READERS SAY

Readers tell us they read the advertising pages as much as the editorial. And for good reason! A good advertisement, like a good editorial article, brings you useful, worthwhile information in the form you want it. That's why it pays to look through the ads in Electrical World carefully.

*Hoskins Mfg. Co..... 53
Hubbard & Co..... 133

Indiana Steel & Wire Co..... 152
Industrial Products Co..... 151
*I-T-E Circuit Breaker Co. Third Cover

Joslyn Mfg. and Supply Co..... 115

Kellett Aircraft Corp..... 56
Kelvinator, Div. of Nash-Kelvinator Corp. 126, 127
Kerite Insulated Wire & Cable Co., Inc., The 68
*Klein & Sons, Mathias..... 140
*Krueger & Hudepohl..... 151
Kyle Corporation 65

*Lapp Insulator Co., Inc..... 12
Locke Insulator Corp.....30, 31

*Macallen Company, The..... 40
*Matthews Corp., W. N..... 153
McGraw Electric Co., Clark Water Heater Div. 153
McGraw-Hill Book Co., Inc..... 145
Miller Company, The..... 37
Mosinee Paper Mills Co..... 131
*Mossman, Inc., Donald P..... 46

National Electrical Mfrs. Ass'n., The Street Lighting Section.... 17
National Telephone Supply Co., The 57

Ohio Brass Co..... 8, 9
*Okonite Co. 4
*Okonite-Callender Cable Co..... 4
Otis Elevator Company..... 48
*Owens-Corning Fiberglas Corp.... 119

Paragon Electric Co..... 138
*Pennsylvania Transformer Co..... 32
*Penn-Union Electric Corp..... 142
Porter, Inc., H. K..... 141
Premax Products, Div. Chisholm Ryder Co., Inc..... 152
Punch-Lok Co. 142

Radio Corp. of America..... 63
*Railway & Industrial Engineering Co. 7
*Reliable Electric Co..... 33
*Rockbestos Products Corp..... 123
*Roller-Smith Co. 51
Rome Cable Corporation..... 117
Royal Electric Mfg. Company..... 149
Ryerson & Son, Inc., Joseph T.... 137

*Schramm, Inc. 23
Scovill Mfg. Co..... 139
Searchlight Section 156, 157
*Sherman Mfg. Co., H. B..... 144
Simplex Wire & Cable Co..... 14
Socony-Vacuum Oil Company, Inc. 15
Solar Electric Corp..... 151
*Spang-Chalfant, Div. of The National Supply Co..... 42
*Stackpole Carbon Company..... 21
Standard Oil Co. (Indiana) Back Cover
*Star Porcelain Co..... 153
*Stewart Iron Works Co., Inc., The 144
Stockwell Transformer Corp..... 143

Union Carbide & Carbon Corp.... 59

Wagner Electric Corp..... 27
Ward LaFrance, Truck Division... 43
Welsbach Engineering & Management Corp. 152
Western Electric Co.....34, 35
*Westinghouse Elec. & Mfg. Co. 44, 45, 54, 112, 113
*Weston Electrical Instrument Corp. Second Cover
Wrigley Jr. Company, Wm..... 150

■

PROFESSIONAL SERVICES 154

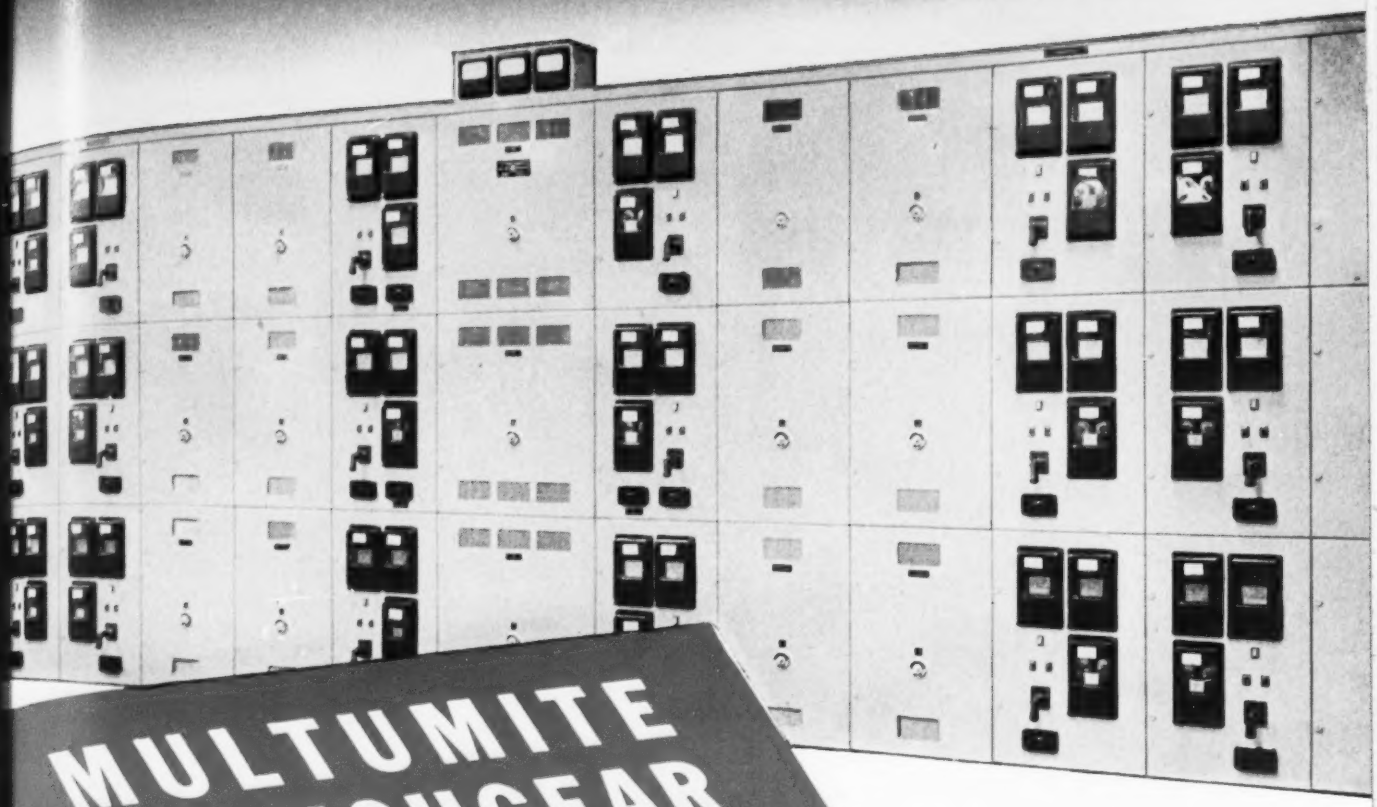
■

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT SERVICE 156
POSITIONS VACANT 156
POSITIONS WANTED 156
SELLING OPPORTUNITIES 156
WORK WANTED 157
USED EQUIPMENT 156-157
Belyea Co., Inc..... 157
Brew, Woltman & Co..... 157
Chicago Electric Co..... 157
Denny & Clark..... 157
Donnelly, Frank 157
Electric Service Co., The..... 157
Electric Meter Corp..... 157
Hemphill & Co., J. L..... 157
Kansas Power Co..... 157
Le Fevre Co., Harvey..... 157
Navy Material Red. & Disp. Off..... 157
Schoonmaker, Robert 157

★ **These companies have supplied additional buying information on their products in the 1945 edition of the Electrical Buyers' Reference.**



MULTUMITE SWITCHGEAR For CENTRAL STATIONS

View of a 440-volt, withdrawal type Multumite switchboard recently furnished a large Eastern Utility for central station auxiliary service.

MULTUMITE ADVANTAGES INCLUDE:

1 **SELF-ALIGNING SEPARABLE CONTACTS** . . . for dependable service. No springs in current path; no pigtails.

2 **ROTARY-TYPE REMOVABLE HANDLES** . . . for fast, positive, emergency operation of enclosed circuit breakers which are normally operated electrically.

3 **WELDED STEEL FRAME** . . . a strong, rigid steel structure maintains proper alignment.

4 **BONDERIZED STEEL** . . . metal is treated so that finish will withstand severe service without cracking or peeling.

5 **FLANGED DOORS** . . . formed and welded into sturdy structural units. Panels at sides, top and back are of similar construction.

6 **CONCEALED HINGES** . . . permit door to be opened a full 100 degrees.

7 **GRILLE-TYPE LOUVERS** . . . give better protection and more ventilation per square inch of opening.

8 **12 FINISHING OPERATIONS** . . . cleaning, spray priming, baking, two spray coats, two bakings, pneumatic sanding and two coats of enamel, both baked.

When considering the selection of switchgear, it will pay you to keep these Multumite advantages in mind. They are indicative of the careful design and painstaking construction that enter into every detail of every product that bears the I-T-E mark.

For complete description of Multumite Switchgear ask your nearest I-T-E representative for Catalog 6002 or write to I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Phila. 30, Pa.

I-T-E

REPRESENTATIVES IN ALL PRINCIPAL CITIES

AIR SWITCHGEAR

ARMY NAVY

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

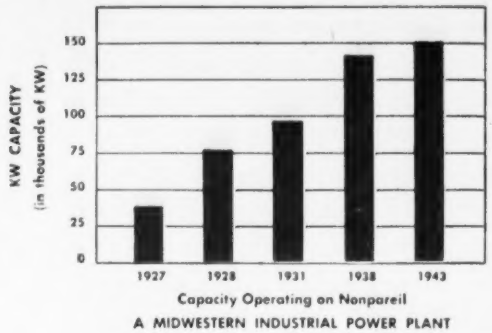
These turbine operators were convinced with the first trial of . . .

NONPAREIL
TURBINE OIL

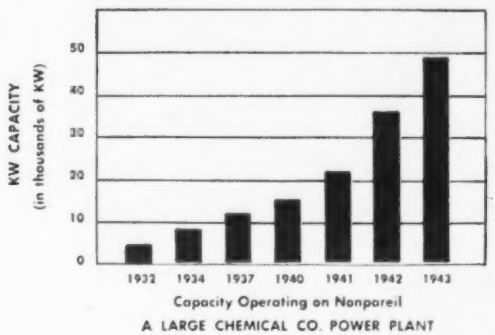
FOUR TYPICAL plant records are pictured here, showing the dates on which Nonpareil was installed in the first turbine in each plant. In some of these plants Nonpareil was on trial.

Operators were told that Nonpareil would eliminate all oil deposits in turbines—that this oil would never need to be removed from the turbine for treating, cleaning, or resting. On top of that, each fill of Nonpareil was *guaranteed in writing* not to exceed the extremely low neutralization number of 0.15 mg. KOH/gm. for the life of the turbine.

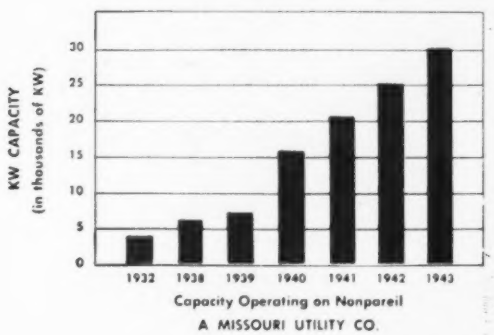
Here's the record. In these four plants, one turbine after another has been converted to Nonpareil. *The first fill did all it was claimed to do.* These plants are typical—there are hundreds like them.



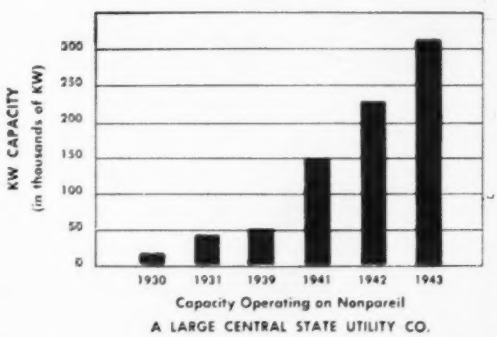
A MIDWESTERN INDUSTRIAL POWER PLANT



A LARGE CHEMICAL CO. POWER PLANT



A MISSOURI UTILITY CO.



A LARGE CENTRAL STATE UTILITY CO.

● A Standard Lubrication Engineer can tell you why Nonpareil is different from any other oil, and how it adds to safety in operation and reduces cost in many plants. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

Buy more War Bonds

STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

★ LUBRICATION ENGINEERING